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Catalog of models and simulations in use by the Armies of the United States, the United Kingdom, Canada and Australia.

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WASHINGTON STANDARDIZATION OFFICERS
C/O PRIMARY STANDARDIZATION OFFICE
NASSIF BUILDING
5611 COLUMBIA PIKE
FALLS CHURCH, VIRGINIA 22041-5011

WSO (7523) QAP 59 — 21 May 1991

SUBJECT: QAP 59 Ed 4 - Catalogue of War Games

SEE DISTRIBUTION

Enclosed is the camera ready copy of QAP 59, Edition 4 - Catalogue of War Games, for national distribution.

FOR THE WASHINGTON STANDARDIZATION OFFICERS:

J.V. Fielding

JV FIELDING
Colonel
Director
Primary Standardization Office

Distribution:

US NSO
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ARMIES
STANDARDIZATION PROGRAM

CATALOG OF WAR GAMES

DECLARATION OF ACCORD

1. PURPOSE

This catalog provides information on the primary war games, combat simulations and training games used by ABCA Armies to support Studies and Analyses or drive Command Post Exercises (CPXs) and Field Training Exercises (FTXs). It is intended to facilitate the exchange of information by describing here key features of current combat modeling techniques. More detailed documentation is available from the designated Point of Contact.

2. SCOPE

The types of combat models considered include both functional area models and force level models. Functional area models are primarily one-sided and focus on the detailed aspects of a particular battlefield functional system, such as the divisional field artillery system. Force level models are two-sided and attempt to represent all or most combined arms and support functions at a given echelon such as division and below. Force level models may be interactive with players performing various command, control, and staff functions or may be systemic (totally computerized) with algorithms used to simulate Command decision logic. Some interactive combat models (wargames) are used for research purposes to assess potential value of new tactics and new weapon systems and other interactive combat models (training games) are used to train Commanders or to drive field training exercises. Force level systemic models (combat simulations) are used typically to investigate weapon system alternatives or force structure tradeoffs when the number of cases of interest exceed the responsiveness capabilities of the slower research games.

3. ORGANIZATION

Table I contains an alphabetical index of combat models by acronym/title.

4. AMENDMENT

The contents of this QAP are to be revised when necessary by the contributing Armies, to reflect development in national practices and to maintain its currency.

5. USE

The information in this QAP should whenever possible be used by Armies to improve the level of standardization or interoperability on primary war games, combat simulations and training games used by ABCA Armies.

6. RELEASE

A statement has been provided on the releasability of each model. It should be noted that the fact that a particular model is releasable does not imply that all requests for release will be approved. Each release will be judged on a case-by-case basis and may require compliance with appropriate configuration control procedures. Also, release to contractors may be prohibited.

FOR THE WASHINGTON STANDARDIZATION OFFICERS:

21 May 1991

J V FIELDING
COLONEL
DIRECTOR
PRIMARY STANDARDIZATION OFFICE

TABLE I. ALPHABETICAL INDEX OF COMBAT MODELS.

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TITLE: Achieving a System Operational Availability Requirement ASOAR

DATE IMPLEMENTED: 1989.

MODEL TYPE: Analysis.

PROPONENT: USA CECOM, Attn: AMSEL-PL-SA, Ft. Monmouth, NJ 07703-5000

POINT OF CONTACT: Mr. Bernard Price, AV 992-1222/(201) 532-1222.

PURPOSE: ASOAR cost effectively prorates a system operational availability requirement to end item operational availability goals. It determines the degree of supportability necessary to achieve each operational availability goal. It also determines the effective reliability and maintainability of the system and effective reliability of redundant configurations.

DESCRIPTION:

Domain: Applicable to all weapon systems.

Span: N/A.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: Weapon system operational availability and reliability analysis.

Level of Detail of Processes and Entities: End items of weapon system is the lowest entity modeled.

CONSTRUCTION:

Human Participation: Required to determine configuration of the weapon system and its forward level support concept.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Analyzes one weapon system at a time.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Development of users's manual prior to model distribution.

TITLE: Air Defence Optimising Model

DEVELOPER: LA2

USER: LA2

PURPOSE: To assist in the selection of air defence mixes and deployment for analysis in the RARE air defence model (q.v.). The model can be used to identify mixes that are robust to changes in scenario or environment, and can be used to conduct rapid sensitivity analysis on resource levels or system costs. It is essential in weapon mix studies as a means of eliminating player variance that would otherwise dominate results.

GENERAL DESCRIPTION: The optimising model is a linear progamming model which is solved using the LAMPS computer package. For a given scenario or set of scenarios the model will choose the most effective mix of weapon systems and sites to defend against a given set of threats subject to constraints on money, manpower and weapon numbers. The primary aim of the model is to provide a balanced defence covering all the given tracks equally well. Maximising expected attrition is a secondary aim. The model measures air defence performance in terms of potential kills. These are the numbers of kills achieved by a weapon against a single raid of aircraft on a track assuming no target starvation, no overkill and no distractions. The potential kills for each site and track combination are determined by running the PARADE model in a special 'data' mode and are used as coefficients in the optimising model. The extent to which the mixes and deployments generated by the optimising model really are the best depends on how representative the input sets of available sites and threat tracks are. It also depends on the extent to which the potential kills can be translated into actual kills in realistic threat scenarios. This requires that the selected mixes and deployments are subjected to detailed analysis in the PARADE simulation to detect and explain any weaknesses.

COMPUTER STATUS: MAGIC/LAMPS Package is available on the VAX 8600. In current use.

DOCUMENTATION: D/DOAE/47/7 of July 1986. QWGAOR Paper, (Accn. No 85698).

TITLE: Air Defense Computer Modeling System - COMO III

DATE IMPLEMENTED: 1986.

MODEL TYPE: Analysis.

PROPONENT: Systems Analysis and Evaluation Office, U.S. Army Missile Command, Redstone Arsenal, AL 35898-5060.

POINT OF CONTACT: Charles E. Colvin, AV 746-1333/(205) 876-1333.

PURPOSE: COMO III is a general-purpose critical event modeling system designed for the writing and development of air defense simulations. It is used to evaluate the operational effectiveness of air defense weapon systems in a realistic tactical scenario. COMO III is used as a research and development tool and an operations support tool.

DESCRIPTION:

Domain: Land and air.

Span: Theater, corps, division, battalion, individual fire unit.

Environment: Electronic battlefield, digitized terrain, meteorological visibility.

Force Composition: Mix of land-based air defense weapon systems and mix of attacking airborne threat and tactical missiles.

Scope of Conflict: Conventional.

Mission Area: All conventional missions of an attacking airborne threat and tactical missiles.

Level of Detail of Processes and Entities: Single aircraft, tactical missile or air defense fire unit.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Event-step with some time-step events.

Treatment of Randomness: Stochastic using both direct and Monte Carlo computation.

Sidedness: Two-sided, asymmetric with one side nonreactive.

LIMITATIONS: Initial setup of game requires large number of labor hours, excessive CPU hours for large-scale scenario, reactive and smart ECM not played, and wild-weasel tactics not simulated for aircraft.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Real-time battlefield graphics display package.

INPUT: Tactical scenario, weapon characteristics, ECM, weather effects, fire unit deployment, firing doctrine, rules of engagement, and defended ground assets.

OUTPUT: Computer printouts, plots, raw data, event-by-event summary, multiple replication statistics, and kill summaries.

HARDWARE AND SOFTWARE:
Computer: CDC 7000 series, CYBER 74, VAX 11/700 series, DEC MicroVAX, DEC 8000 series, GOULD, HP 9000, UNIVAC.
Storage: 160K octal for non-virtual memory computer.
Peripherals: 1 VT100 terminal and 1 high-speed printer.
Language: FORTRAN 77.
Documentation: Fully documented.

SECURITY CLASSIFICATION: UNCLASSIFIED, but data bases are often classified.

GENERAL DATA:
Data Base: Minimum 0.5 man-year, maximum 6 man-years.

CPU Time per Cycle: Variable.

Data Output Analysis: Variable depending on level of expertise of analysts.

Frequency of Use: Continuously.

Users: TRADOC, MICOM, CAA, AMSAA, USA MSIC, numerous contractors.

Comments: COMO III is managed by the MICOM COMO Model Management Board.

DATE IMPLEMENTED: 10/29/90

TITLE: Air Defense Simulation System (ADSS)

MODEL TYPE: Analysis - Stochastic, discrete event functional area combat model of air defense.

PROPONENT: Concepts & Studies Division, Combat Developments Directorate, U.S. Army Air Defense Artillery School, Ft. Bliss, TX

POINT OF CONTACT: Mr. Luis Alvarez, USAADASCH, ATSA-CDC-M, Ft Bliss, TX, (915) 568-1233; Dr. Carol Burleson, COLSA, Inc. (915) 779-5899.

PURPOSE: Analysis of the combat effectiveness of air defense systems, tactics, and doctrine; and development of air defense scenarios and laydowns over terrain.

DESCRIPTION: The ADSS Model computerized, two-sided, systemic, stochastic model for the analysis of air defense weapon effectiveness and air defense tactics, doctrine, and employment/deployment. The model is data-driven and allows existing, improved, developmental, and conceptual air defense systems to be simulated by placing sensors, weapons, and munitions with a variety of characteristics on platforms. Either side may use any system characteristics, tactics, doctrine, and decision rules which the model can simulate. ADSS attrits and models the functions of individual sensors, weapons, and rounds. It is designed for rapid, user-frendly setup: all input files other than terrain are in ASCII free format. Scenario sizes range from one-on-one to division or corps slice. The ADSS Model is written in SIMSCRIPT II.5 and FORTRAN and is run without user interference. It may be executed in batch mode. The color graphics preprocessor can be used to develop flight and ground movement profiles and laydowns for weapons, sensors, and defended assets over terrain display with elevations and feature overlays. Scenario files can be ported directly to the model as input. The code is written in the C language interactive, and uses hierarchies of menus. Features include:
- dynamic line-of-sight on DTED Level I terrain with DFAD feature overlays for foliage and obstacles
- ground movement by AD systems and defended assets
- ground-to-air and air-to-ground engagement
- decision rules for target selection, engagement decisions, and ROE
- dynamic acquisition using integrated CNVEO (NVEOL) VISPOE models

CONSTRUCTION: ADSS was originally developed as a model for FAADS weapons and sensors by COLSA, Inc., El Paso, TX and delivered to DCD, USAADASCH, in 1988. The simulation model was then called ADAsim (Air Defense Artillery Simulation) and was written in the General Simulation System (GSS) simulation environment. In 1989, COLSA completely rewrote the simulation model as an internal IR&D project and delivered the resulting model to DCD. The ADSS Model is now a generic, data-driven air defense model in SIMSCRIPT II.5. The preprocessor, which runs on a Silicon Graphics Iris 3000 series Workstation, was modified for consistency with the model. The postprocessor, originally in SPSS, is being rewritten in FORTRAN. COLSA maintains the ADSS and provides configuration management for the current ADSS model, preprocessor, and postprocessor under contract with DCD, USAADASCH. ADAsim (GSS) and the postprocessor in SPSS are maintained by DCD, USAADASCH and are no longer supported by COLSA.

LIMITATIONS: Runs only on Silicon Graphics 3000 Series Workstations; Does not move entities on the terrain during scenario development; Run and setup time highly scenario dependent; flight profiles must be

PLANNED IMPROVEMENTS AND MODIFICATIONS: Ground-to-air ID module: IFF, ASM, ROE, NCTR; Dynamic ECM-broadband jamming; New flightpath generator based on BLUEMAX and HELIPAC from SURVIAC; New statistical postprocessor.

INPUT: Material characteristics: Radar detection param; RF emitter and detector param (IFF, ESM, etc.); Optical/electro-optical sensor param; Weapon characteristics; Platform dimensions & velocities; Munition flyout data; Jammer param; Threat & friendly munition lethalities vs aircraft and ground target types; Round-target matrix; Scenario files

OUTPUT: For each replication: Event histories for selected vehicles, side event types; For single or multiple replications: Detection, tracking, engagement, damage, and attrition means and range histograms vs target, weapon, sensor, and round types

HARDWARE AND SOFTWARE:

COMPUTER (OS): ADSS Model and Postprocessor - VAX VMS; Preprocessor - Silicon Graphics Iris 3000 Workstation under UNIX.

STORAGE: Currently running on DEC VAX 3600 with 16 Mb virtual memory and 622 Mb disk; Silicon Graphics Workstations have two 180 Mb disks.

PROGRAMMING LANGUAGE: Model and Postprocessor - SIMSCRIPT II.5 and FORTRAN; Preprocessor - C and SG 3000 GL (C-based).

DOCUMENTATION: User Manual (input file and element descriptions); Technical Manual; Executive Summary; Preprocessor Manual; and Postprocessor Manual.

OTHER COMMENTS: Large terrain data files may result in unacceptably long model execution times during interaction with preprocessor.

SECURITY CLASSIFICATION: All code is UNCLASSIFIED. Databases may be classified if systems can be identified.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Time required for 2 deg by 2 deg input file averages 3-4 hours of elapsed time on equipment described above (varies with density).

CPU TIME PER CYCLE: 1-5 minutes per cycle on the VAX with a dedicated system and FAADS platoon level scenarios with less than 20 aircraft.

DATA OUTPUT ANALYSIS: Highly dependent on the scenario and the analysis at hand. Output summary displays for each rep are easily compared

FREQUENCY OF USE: Two studies using the ADSS model are in progress at COLSA. Preprocessor is used on average of every 2 months for stand-alone.

USERS: DCD, USAADASCH; COLSA, Inc.

COMMENTS: None.

TITLE: Air-to-Air Infrared Missile Model - ATAS

DATE IMPLEMENTED: 1987.

MODEL TYPE: Analysis.

PROPONENT: Directorate For Systems and Cost Analysis (AMSAV-BA), U.S. Army Aviation Systems Command, 4300 Goodfellow Blvd, St Louis, MO 63120-1798.

POINT OF CONTACT: William E. Bodden, DSN 693-1155

PURPOSE: RESEARCH & EVALUATION TOOL (COURSES OF ACTION ASSESSMENT). Provides a tool to help determine safety of fire envelopes when launching a Stinger missile from a helicopter. Model is designed to track the distance between the missile and its platform; it is a modification of MICOM's Ground-to-Air Infrared Missile Model.

DESCRIPTION:

Domain: Land and air.

Span: Individual helicopter.

Environment: Sensitive only to height above sea level and relative location of ground to target.

Force Composition: Single helicopter

Scope of Conflict: No conflict involved; target is passive.

Mission Area: Standard firing of Stinger in air-to-air or air-to-ground role.

Level of Detail of Processes and Entities: A single attacker aircraft fires a single Stinger missile against a passive, moving, ground or air target.

CONSTRUCTION:

Human Participation: None required or permitted.

Time Processing: Dynamic, time step model.

Treatment of Randomness: Basically deterministic.

Sidedness: Two-sided, asymmetric, one side non-reactive.

LIMITATIONS: Can only model Stinger missile; requires detailed flight paths; seeker lock cannot be broken due to low signal-to-noise ratio or clutter.

PLANNED IMPROVEMENTS/MODIFICATIONS: Incorporation of aircraft yaw, pitch, and roll on initial missile velocity; new roll rate algorithm; better approach to downwash.

INPUT: Attacker and target flight paths; relative locations at start; downwash data; breakdc . of attacker aircraft into cylinders; other attacker geometry.

OUTPUT: Attacker, target, and missile parameters for selected time steps; miss distances between platform and missile and between platform and launch motor; miss distance of missile to target; total missile drop.

HARDWARE AND SOFTWARE:
Computer: DELL System 310 w/Bernoulli Box II; uses MS-DOS operating system.
Storage: 256K bytes
Peripherals: Printer.
Programming Language: FORTRAN
Documentation: (Basic MICOM missile model) : Technical Report RD-83-13, Stinger Post Hybrid/Digital Simulation Implementation (U), David M. Curry, Victor S. Grimes; Systems Simulation and Development Directorate, U.S. Army Laboratory, U.S. Army Missile Command, Redstone Arsenal, AL 35809; August 1983 (CONFIDENTIAL); (AVSCOM Modifications): Technical Memorandum, Overview: AVSCOM Air-to-Air Modifications to MICOM Infrared (IR) Ground-to-Air Missile Fly-out Simulation Model (Interim Report), Arnold V. Arconati, William E. Bodden; Directorate for Systems and Cost Analysis, US Army Aviation Systems Command, 4300 Goodfellow Blvd., St Louis, MO 63120-1798 (UNCLASSIFIED).

SECURITY CLASSIFICATION: CONFIDENTIAL.

GENERAL DATA:
Data Base: Varies; probably averages about two months - drivers are the flight paths and the breakdown of the platform into cylinders.

CPU Time per Cycle: 5-10 minutes.

Data Output Analysis: Varies; relatively short time period since miss distances are printed out.

Frequency of Use: Variable

Users: AVSCOM Directorate for Engineering and Air-to-Air Stinger Office.

Comments: All missile related algorithms are intact from the original MICOM model.

Releasability: Only releasable with the permission of the Stinger PM at MICOM.

TITLE: Ammunition Sustainability Life Cycle Model - ASLCM

DATE IMPLEMENTED: August 1987.

MODEL TYPE: Analysis.

PROPONENT: PM AmmoLog, Mr. Gary Kent.

POINT OF CONTACT: HQ, Army Materiel Command, Attn: AMCAM (Ms. Gulledge), 5001 Eisenhower Avenue, Alexandria, VA, 22333-0001, DSN: 284-8484/3332.

PURPOSE: To provide a macro management tool that pinpoints constraints in the flow of ammunition from production to user, identifies, the magnitude of the constraints and parametrically assists in determining impact if constraints are alleviated.

DESCRIPTION: The ASLCM simulates the flow of ammunition from production to end user. The simulation includes rates (expenditures, handling, and production), capacities (storage and lift handling), resources (containers and ports, breakbulk and container berths), transporters (types and velocities, nodes and distances), and entities to include initial distribution of assets and quantities produced and moved. Simulations are based on: Flow doctrine, realistic stockage quantities, transportation factors, port studies and USAREUR plans, "P" or other expenditure rates, distance and container status data, and storage and production base mobilization estimates.

Domain: Land, sea, and air.

Span: Global.

Environment: Transportation sites.

Force Composition: Joint forces.

Scope of Conflict: Conventional.

Mission Area: Sealift, airlift, rail, and trucks.

Level of Detail of Processes and Entities:
Entities: Planes, ships, trucks, and railcars.
Processes: Movement of ammunition by all entities.

CONSTRUCTION:
Human Participation: None after the initial startup, however, is not interruptible without losing information.

Time Processing: Dynamic.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: Asymmetric, all sides reactive.

LIMITATIONS: The only limitations of the model are the limitations of the SIMAN/CINEMA software programs.

INPUT: A series of information to achieve the desired scenario (user-specified parameters). This information includes: Method of shipment; i.e., rail, ship, truck or air; locations of shipment and receipt; theater of operations (Europe, Korea, etc); requirements; capacities; interaction among nodes in the movement doctrine; etc.

OUTPUT: Outputs can be in the form of bar charts, histograms, plots, tables of values, correlograms, confidence intervals, mean test, moving averages, standard deviation confidence intervals, one-way analysis of variance of data, comparison of estimated variances, text file DIF format, and ASCII-formatted files.

HARDWARE AND SOFTWARE:
Computer: IBM or IBM-compatible personal computer with SIMAN/CINEMA software.
Peripherals: Graphics printer.
Programming Language: SIMAN.
Documentation: Users manual. However, the model is releasable but can only be run on the SIMAN/CINEMA software which is proprietary and NOT RELEASABLE due to distribution restrictions. The outputs are RELEASABLE.

SECURITY CLASSIFICATION: UNCLASSIFIED (could become classified depending on input of data).

GENERAL DATA:
Time Requirements: 30-45 minutes.

Data Output Analysis: 30-45 minutes.

TITLE: Analysis of Force Potential DATE IMPLEMENTED: 1985.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency.

POINT OF CONTACT: George Stoll, AV 295-5259/CM (301) 295-5259.

PURPOSE: Quantify firepower potential of land combat forces of division size and larger for use in analysis of force levels and force ratios. Has been used primarily to analyze changes in total Army force potential attributable to force modernization. Has most recently been applied to analyze changes in force potential and force ratios associated with various proposed reductions in weapon procurement and U.S. and Soviet force size.

DESCRIPTION:

Domain: Land combat, limited close air support.

Span: Division level combat.

Environment: Models day and night combat and clear and degraded visibility in the full range of combat posture desired for a study.

Force Composition: Army.

Scope of Conflict: Conventional.

Mission Area: Direct fire battle, close air support, indirect artillery.

Level of Detail of Processes and Entities: Models individual weapons in weapon-on-weapon engagements through processes of detection, direct fire, indirect artillery, and attrition.

CONSTRUCTION:

Human Participation: Not permitted, model not interruptible.

Time Processing: Static.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: No representation of terrain or logistical support effects.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Major program underway to separate stochastic elements from deterministic elements. Stochastic element will be run in batch process and put into library; deterministic element will draw from library.

Deterministic element will be implemented on microcomputer; stochastic element likely to remain on mainframe.

INPUTS: Unit weapon composition, probability of kill tables, sensor characteristics, and scheme of weapon versus weapon engagement pairings.

OUTPUTS: Attrition tables, weapon firepower values, and force firepower scores.

HARDWARE AND SOFTWARE:
Computer: Currently Unisys 1100 mainframe, future IBM-compatible microcomputer.
Storage: Currently 240,000 words.
Peripherals: Tape drive, line printer.
Programming Language: FORTRAN 77
Documentation: Operator's and Programmer's Guide to the Analysis of Force Potential System (AFPSYS).

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Database: 2-3 months.

CPU time per cycle: 30 minutes.

Data Output Analysis: 1 week.

Frequency of Use: 5-6 times per year.

Users: U.S. Army Concepts Analysis Agency.

Releasability: Releasable.

DATE IMPLEMENTED: 08/15/90

TITLE: Armored Battalion Recovery and Maintenance Simulation (ARMSIM) Model

MODEL TYPE: Analysis

PROPONENT: U.S. Army Ordnance Center and School (USAOC&S), Aberdeen Proving Ground (APG), Maryland 21005-5201

POINT OF CONTACT: Mr. Brice, ATSL-CD-CS, AV 298-2028/2803 USAOC&S, APG, Maryland 21005-5201

PURPOSE: Research & Evaluation, Weapons Systems, Systems Development & Effectiveness, Combat Development, Current or New Doctrine.

DESCRIPTION: Land, local, typical European battlefield, armored battalion/brigade, conventional & chemical, recovery & maintenance simulated battle, reliability failure or combat damage requiring recovery or maintenance.

CONSTRUCTION: Human participation not required, scheduled changes are permitted, dynamic, event step, stochastic, Monte Carlo, one-sided.

LIMITATIONS: Currently limited to tanks and armored maintenance vehicles; could easily be expanded, e.g., to add Bradleys.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Plan to add capability to model maintenance and recovery concepts of allies.

INPUT: Mean time between failures/kills, mean recovery time, mean repair time, other parameters describing these distributions, maintenance & recovery concepts & performance factors, dimensions of the battlefield, vehicle speed.

OUTPUT: Printout of tank availability, losses, & maintenance & recovery work day. Video animation of the simulated recovery & maintenance operation. Standard summary report with plots and statistically analyzed data is available.

HARDWARE AND SOFTWARE:

COMPUTER (OS): IBM compatible 386 or 286 machine with DOS 3.0 or higher. Windows 286 or higher.

STORAGE: 10 Mb hard disk. 640 K ram.

PERIPHERALS: EPSON FX compatible printer.

PROGRAMMING LANGUAGE: SLAMSYSTEM 1.0 or higher. FORTRAN 4.0 or higher.

DOCUMENTATION: SLAMSYSTEM User's Guide.

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: No database

CPU TIME PER CYCLE: Less than 1 minuted per run, plus the specified animation time.

DATA OUTPUT ANALYSIS: None required.

FREQUENCY OF USE: As required.

USERS: Directorate of Combat Developments, U.S. Army Ordance Center & School, APG, MD 21005-5201

Title: Army Planning Model   Date Implemented: See Comments

Model Type: Analysis

Proponent: 1. D/Army Plans - for operational use in planning.
2. DOAE - for future OA development.

Point of Contact: 1. D/Army Plans, SO/APM.
2. DOAE, Technical Advisory Group.

Purpose: Brings together planning framework, Army physical framework and cost framework in a common model/data base structure to assist with development and analysis of options in future planning.

The operational analysis function is to provide a tool for quickly identifying and costing appropriate physical elements of the Army in support of effectiveness studies.

The model is hierarchical permitting costing at several levels of activity and has the facility to represent support costs either directly or in the form of overheads.

DESCRIPTION

Domain: Land
Span: Global
Environment: N/A
Force Composition: Basically Army regiments and smaller elements where appropriate but with facility to aggregate up to capability level.
Scope of Conflict: N/A
Mission Area: N/A
Level of Detail of Processes and Entities: Generally an Army regiment is the building block to which assets, costs, and outputs are attributed for aggregation to higher levels and for attribution of support costs.

CONSTRUCTION

Human Participation: Selection of required facilities via menu hierarchy.
Time Processing: Static, but containing 10 years data.
Treatment of Landowners: N/A
Sidedness: One-sided
INPUT: Annual input of complete data base derived from Long Term Costing. Data includes latest ORBAT, costs, equipment and support elements.
OUTPUT: A range of specified and ad hoc outputs available generally in the form of a particular option and its costs.

HARDWARE & SOFTWARE

Computer: DEC VAX under VMS.
Storage:
Peripherals:
Programming Language: FORTRAN 77 and ORACLE RDBS
Documentation: Extensively documented, including technical specifications and user manuals.

SECURITY CLASSIFICATION: Data base SECRET

Comments: Model scheduled for transfer from DOAE VAX to a dedicated VAX during 1991. Model expected operational on DOAE VAX Dec 1990.

TITLE: Army Training Battalion Simulation System - ARTBASS

DATE IMPLEMENTED: 1977.

MODEL TYPE: Training and education.

PROPONENT: Department of the Army, Project Manager for Training Devices (PM TRADE), 12350 Research Parkway, Orlando, FL 32826-3626.

POINT OF CONTACT: J. Baldauf, DSN: 552-3626/(913) 684-3626.

PURPOSE: ARTBASS is a Battalion Command Post Exercise (CPX) Driver. It is used primarily to train Battalion Commanders and their staffs in the conduct of land (deep) battle operations.

DESCRIPTION:

Domain: Land and air in that air strikes and air defense are modeled.

Span: Regional: 5,000 square kilometer area; accommodates Central Europe, Korean Peninsula, SINAI, Ft Irwin, and SW Asia; other terrain databases could be prepared.

Environment: Models terrain relief for LOS and mobility, weather, time of day, terrain cultural features such as built up areas like cities, and natural and manmade barriers (roads, rivers, bridges, terrain vegetation, minefields).

Force Composition: Army Battalion Forces, Blue and Red.

Scope of Conflict: Conventional weapons for Blue and Red (mid and high intensity conflicts).

Mission Area: Conventional missions.

Level of Detail of Processes and Entities: Nominally models down to the Platoon level. Can model squads and single vehicles/soldiers, model is more efficient for smaller number of units. Movement, conflict and Combat Damage Assessment (CDA) affect supplies, ammunition and POL levels for all entities. Communications and IEW affects on communications are also modeled.

CONSTRUCTION:

Human Participation: Required for decisions and for processes. Model will wait for a decision.

Time Processing: Model is dynamic and time stepped; ratio of game time to real time is user justified.

Treatment of Randomness: Model is stochastic and Monte Carlo.

Sidedness: Model is two-sided, but not quite symmetric.

LIMITATIONS: ARTBASS has only 200 units and doesn't model air per se or nuclear, biological, chemical (NBC) warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Increase number of units to 300 and model air and create better printouts.

INPUT: Requires extensive data base containing information about weapon types and capabilities, units, and terrain.

OUTPUT: Graphics display of combat situation including separate 3 dimensional view of terrain; display can be based on acquired intelligence of a unit or on a ground truck. Reports can be generated Ad Hoc during the game as well as afterwards for review.

HARDWARE AND SOFTWARE:

Computer (OS): ARTBASS runs on a CONCURRENT formerly Perkin-Elmer computer with the OS/32 operating system.

Storage: Removable disk storage has two 300 megabytes (MB) at the development site and one 300MB at the development site and at each of the nine fielded sites. The Central Processing Unit (CPU) memory is sixteen MB at each site. There are also two tape drives at 1600 Bits Per Second (BPS) at each site.

Peripherals: Each of the nine fielded and one development/maintenance sites have one high speed printer; six graphics suites each including two color monitors, two terminals, one bit pad, one touch screen monitor and one printer; and two terminals.

Programming Language: FORTRAN.

Documentation: Extensive documentation following the DoD MIL-STD-1644 for the Post Deployment Software Support (PDSS) effort.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:

Data Base: Usually it takes a few man-weeks to update.

CPU Time per Cycle: Depends on the scenario being used, for small scenarios time can be as low as ten sec/cycle.

Data Output Analysis: There are post processor reports, but the majority of the analysis is done manually.

Frequency of Use: Some sites are booked to train for more than the next two years.

Users: Ft. Lewis, Ft. Hood, V Corps, VII Corps, Ft. Bragg, Korea, Ft. Carson, Ft. Campbell, and Ft. Devens - fielded sites.

Comments: Managed through a configuration control board (CCB).

Releasability: Executable code is available for release to the field through the CCB.

TITLE: Attack Helicopter Air-to-Air Fire Control System Simulation Model - ARTOAR

DATE IMPLEMENTED: 1987.

MODEL TYPE: Analysis.

PROPONENTS: U.S. Army Armament Research, Development and Engineering Center (ARDEC), Dover, NJ, and U.S. Army Aviation Applied Technology Directorate (AATD), Ft Eustis, VA.

POINT OF CONTACT: Mr. Ed Gilsky (ARDC), DSN 880-7969.

PURPOSE: RESEARCH & EVALUATION TOOL (SYSTEMS EFFECTIVENESS). To assess the effectiveness of a turreted gun system and/or Hydra 70 rockets, and accompanying fire control system, in one-on-one, non-dueling helicopter air-to-air (ATA) combat engagements.

DESCRIPTION:

Domain: Air.

Span: Individual helicopter.

Environment: Sensitive only to altitude.

Force Composition: Single Helicopter.

Scope of Conflict: No conflict involved; target is passive.

Mission Area: Any conventional mission.

Level of Detail of Processes and Entities: A single attacker helicopter fires a turreted gun, or Hydra 70 rockets, against a passive, moving air target.

CONSTRUCTION:

Human Participation: None required or permitted.

Time Processing: Dynamic, time-step process.

Treatment of Randomness: Model is stochastic. Sensor error is done by a Monte Carlo technique, final results by direct computation.

Sidedness: Two-sided, asymmetric, one side non-reactive.

LIMITATIONS: Non-duelling; flight paths not aircraft specific; requires highly detailed ballistic data for each projectile used; has not been validated.

PLANNED IMPROVEMENTS/MODIFICATIONS: Addition of dueling routine, and more tracking filters; improvement of sensor and turret models, and use of actual flight data.

INPUT: Engagement scenario (i.e., target and attacker flight paths), target vulnerabilities, sensor measurement errors, projectile "real world" ballistic data, and flags for determination of sensors, filters and prediction types to be used by attacker.

OUTPUT: Summary file of engagement, including burst probability of kill and individual bullet end game data; bullet-by-bullet flight path and miss distance data; detailed sensor and fire control equations performance during the engagement at a user specified time step; and data to be used by a plot routine to graphically study the performance of the fire control equations.

HARDWARE AND SOFTWARE:
Computers: VAX 8530, CDC 6600, IBM 4381, SUN Workstation, and DELL System 310, w/Bernoulli Box II.
Peripheral Equipment: Printer; graphics terminal to output graphs if requested.
Programming Language: FORTRAN 77
Documentation: Teledyne Systems Company Final Report, Part I - Technical, Part II - User's Manual; August, 1983.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: Four months to acquire and structure data in model format and learning time.

CPU Time Per Cycle: Playing time is 5-15 minutes for 20 iterations; CPU time per model cycle is contained in the playing time.

Data Output Analysis: Time to analyze and evaluate results is variable.

Frequency of Use: Variable; project dependent.

Users: US Army Research, Development and Engineering Center; Teledyne Systems Co.; McDonnell Douglas Helicopter Co.; Bell Helicopter Textron, Inc.; Boeing Helicopter Company; Sikorsky Aircraft Division; Wright-Patterson AFB (Aeronautical Systems Division); and US Army Materiel Systems Analysis Activity.

Comments: Current changes to the model include an increased resolution of target representation, addition of several tracking filters and a new projectile, and addition of more engagement files.

Releasability: Not Releasable.

TITLE: Battalion/Brigade Simulation - BBS

DATE IMPLEMENTED: 1991.

MODEL TYPE: Training and Education.

PROPONENT: U.S. Army Project Manager for Training Devices (PM TRADE), 12350 Research Parkway, Orlando, FL 32826

POINT OF CONTACT: Mr. J. Simons, DSN 960-4336/Comm (407) 380-4336.

PURPOSE: BBS is primarily used to train Brigade and Battalion commanders and their staffs in the exercise of command and control during execution of Air Land Battle (ALB) operations. The model is a single or multi echelon Command Post Exercise (CPX) driver.

DESCRIPTION:
Domain: Land and air.

Span: Accommodates any 10,000 to 30,000 square kilometer land area. Several databases are currently available, others have been proposed.

Environment: 100m X 100m square based. Models terrain relief for LOS and mobility, roads, rivers, barriers and built-up areas (cities). Models time of day and weather.

Force Composition: Army forces, Blue and Red.

Scope of Conflict: Conventional, nuclear and chemical warfare, both Blue and Red (mid and high intensity conflicts).

Mission Area: Conventional, nuclear and chemical Air Land missions.

Level of Detail of Processes and Entities: Nominally models down to Platoon level for Battalion CPX, down to Company for Brigade CPX. Can model squads, single vehicles/soldiers and single aircraft for reconnaissance or other special missions, but model is more efficient for smaller number of units. Personnel modeled by MOS for each entity. Movement, conflict and Combat Damage Assessment (CDA) affect supplies, ammunition and POL levels for all entities. Communications and IEW affects on communications are also modeled.

CONSTRUCTION:
Human Participation: Required for decisions and processes. Model will continue to run without decisions.

Time Processing: Dynamic, time stepped model. Progresses through processes at user specified ratio of exercise time to real time.

Treatment of Randomness: Land and air attrition deterministically based on Lanchester Coefficients.

Sidedness: Two-sided, symmetric. Red side has less complex logistics play.

LIMITATIONS: Does not model low intensity conflict or biological warfare. Does not model Naval operations.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Seminar mode, interface to ATCCS and linkage to other models (CCTT and CBS) are Pre-Planned Product Improvements.

INPUT: Scenario preparation requires input of Table of Organization and Equipment (TOE) for each unit, and each units starting location and percentage strength. Unit templates and default conditions are available. Exercise control requires input of orders through use of alpha-numeric terminal menu screens and graphics pointer device (mouse).

OUTPUTS: Output of reports is to alpha-numeric terminals and printer, maps and unit positions output to graphics display system.

HARDWARE AND SOFTWARE:
Computer (OS): Digital Equipment Corp. (DEC) MicroVAX systems with VMS operating system (fielded on MicroVAX II and 3100; 10 MV IIs or 5 MV 3100s per system).
Storage: Minimum requirement per MicroVAX: 140 MB disk space, 95 MB tape drive, 16 MB RAM.
Peripherals: Each of ten (10) workstations requires the following: 1 graphics controller, 1 laser disk player, 1 26" color monitor, 3 terminals, 1 printer.
Programming language: Modula II.
Documentation: Operator's and User's manuals are currently available. Technical and software documentation will be provided when the objective system is released.

SECURITY CLASSIFIED: UNCLASSIFIED.

GENERAL DATA:
Database: Weapon characteristics database and terrain databases are static, and sufficient for most scenarios. Estimate several man-months effort to add new or additional weapon systems, two or more man-years to prepare new terrain databases. Scenario databases are dynamic. ECG should be capable of creating a new scenario within an 8 hour period.

CPU Time per Cycle: Varies proportionally with size of exercise (number of units) and complexity of scenario. No statistical data is currently available.

Data Output Analysis: No special tools currently available. Sufficient reporting capabilities available to conduct a thorough review of the combat situation, but analysis must be done manually.

Frequency of Use: Normal minimum usage will be semiannually for active and once per year for reserve components. Actual usage will depend on local command policy.

Users: BBS will be fielded to active/reserve components independently at approximately 38 locations.

Comments: Interim BBS (IBBS) has been fielded to several sites with positive user response. Objective system will run on CBS workstation hardware.

Releasability: Executable code releasable to all US Army activities, and other approved parties. Source code released only with approval of Configuration Control Board.

DATE IMPLEMENTED: 10/24/90

TITLE: Battlefield Planning System (BPS)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command-White Sands (TRAC-WSMR)
White Sands, NM 88002-5502

POINT OF CONTACT: MAJ Bruce Robinson, TRAC-WSMR

PURPOSE: A decision aid to assist the maneuver brigade and division staffs with the planning process.

DESCRIPTION: An automated decision aid that performs terrain analysis using digital terrain data, wargames courses of action through combat modeling, and produces operational documents such as orders and overlays to support the selected course of action.

LIMITATIONS: Availability and detail of digital terrain data. Availability of weapons performance data.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

HARDWARE AND SOFTWARE:

COMPUTER (OS): Hewlett-Packard 9000/300 series computer with UNIX operating system.

STORAGE: 15 Mb disc space, 4 Mb RAM required. Terrain data stored on cartridge tape.

PERIPHERALS: BW or color printer, mouse, high resolution color monitor, cartridge tape drive, large scale mechanical plotter.

PROGRAMMING LANGUAGE: Pascal and C.

DOCUMENTATION: User's manual and technical documentation.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Digital terrain data, weapons performance data, historical weather data.

CPU TIME PER CYCLE: Combat model: 5 min cpu time = 60 min battle time. Terrain analysis: Varies on whats being done.

DATA OUTPUT ANALYSIS: Combat model: Various measure of effectiveness data provided. Terrain analysis: User interprets output.

FREQUENCY OF USE: Depends on user.

USERS: CGSC, TRAC-WSMR, USMA, ETL, TEXCOM, HQ III Corps, 1st ID, 1st CD, 4th ID, 2nd AD, 3rd ACR, 35th ID, Engr School, PM-OPTADS.

COMMENTS: Model incorporated into Maneuver Control System (MCS). Proponency to passed off to PM-OPTADS nlt May 91.

TITLE: Battlefield Related Analysis of Concepts and Hardware BREACH

DATE IMPLEMENTED: 1984.

MODEL TYPE: Analysis (BREACH is a programming language used to develop small unit battlefield engagement simulations).

PROPONENT: U.S. Army ARDEC, Advanced Systems Concepts Office, Concepts Analysis Division, Picatinny Arsenal NJ 07806-5000.

PURPOSE: BREACH is a programming language used primarily in research and development areas. In some instances it is used in analyses of weapon systems to evaluate their effectiveness against various targets as well as their effectiveness in mixes with other systems. Since BREACH is a programming language, tactics could be altered with coding changes, therefore combat development issues which involve doctrine questions can overlap and integrate with effectiveness issues.

DESCRIPTION:

Domain: BREACH has land, air, and water capabilities in its language structure.

Span: Mainly coded for studies of individual systems at company level and below.

Environment: Square-based grid system with detailed terrain maps for vegetation, elevation, mobility and obstacles. BREACH features the capability to convert each square grid into two triangles to represent continuous terrain. Models roads, rivers, and barriers. BREACH is excellent for representing buildings and urban warfare modeling.

Force Composition: Basically recommend starting at company level or below, with some supporting elements (e.g helicopters, artillery, mortars, etc.) Plays Blue vs Red engagements.

Scope of Conflict: Conventional type weapons.

Mission Area: All conventional missions.

Level of Detail of Processing and Entities: Individual elements (tanks, APCs, helicopters, soldiers, etc). Attrition data may be input as a single Monte Carlo based probability of kill or taken in whatever format given. Attrition data is usually derived from other performance models. BREACH also gives the capability to "hook in" performance models as subroutines. Movement may be done at the organization level or individual unit level as required with simple BREACH language commands (e.g. PATH and MOVE commands). Communications must be explicitly modeled by the programmer if needed.

CONSTRUCTION:

Human Participation: A capability exists to develop models with user interaction, however models written at the present do not require human interaction.

Time Processing: Normally dynamic, event-sequenced.

Treatment of Randomness: Can be either stochastic or deterministic, depending on model written.

Sidedness: Can be either one- or two- sided depending on the problem to be modeled.

LIMITATIONS: Requires user to program engagements.

PLANNED IMPROVEMENTS/MODIFICATIONS: Currently runs on the CDC 6600 and Cyber 825 computers at ARDEC. PC-Version forthcoming in 1991.

INPUTS: Parameters for mines, minefields, rollers, plows, munitions, sensors, vehicles, and weapons systems must be input for basic data. Also need movement data as well as routes of advance for groups of units. Once this basic data is provided the user then develops the engagement through the use of the BREACH commands.

A newly developed BREACH Preprocessor downloads data files from the Combined Arms and Support Task Force Evaluation Model (CASTFOREM). Most input data mentioned above will be gathered from CASTFOREM using the preprocessor for data consistency purposes. Scenario development for BREACH models will be derived as subsets of CASTFOREM scenarios and aided by the use of the preprocessor.

OUTPUT: Standard output includes event tables, vehicle losses, and plots as well as any output the programmer develops with the use of BREACH output commands.

HARDWARE AND SOFTWARE:

Computer: Main execution on the CDC 6600 and Cyber 825 using the NOS/BE operating system.

Storage: Depends on model written however typical models execute with between 150000 and 240000 octal core.

Peripherals: The BREACH Preprocessor was developed to execute on a Zenith ZWX-248-62 PC.

Programming Language: BREACH is written in FORTRAN. The Preprocessor is written in Turbo PASCAL and DBASE IV.

Documentation: BREACH programmer, analyst, and users' manuals. Preprocessor documentation available February 1991.

SECURITY CLASSIFICATION: UNCLASSIFIED but data often classified.

GENERAL DATA:

Data Base: One month from scratch, one or two days when downloaded from CASTFOREM based scenario.

Engagement Scenario Development: One to four weeks depending on engagement scenario modeled and user's experience.

Learning Time to Exercise Previously Written Engagements: One to three days.

CPU time per Replication: Depends on engagement scenario developed.

Data Output Analysis: Programmer may develop output analysis using BREACH commands.

Frequency of use: Two to three engagement simulations typically developed per year.

Users: Advanced Systems Concepts Office, ARDEC in support of PM-GMG, Armament Engineering Directorate (Precision Munitions), Close Combats Armaments Center (Tank Munitions).

Comments: BREACH is an alternative to the development of larger operational models for evaluating new technologies. The concept is to build smaller scale battlefield engagement simulations derived from the larger models. The smaller models are a snapshot of force-on-force models where technology improvements will have an effect on the outcome of tactical operations. The smaller models can be increased in detail where required to explore fighting capability improvement with a new concept. It is a quicker, simpler, less expensive solution. Payoffs to ARDEC: Adequate consideration in decision making processes for new concepts, particularly at the TRADOC force-on-force level; Increased understanding of the way new technology concepts play in battlefield situations.

TITLE: Battlegroup Model (BGM) Date Implemented: 1983/84

MODEL TYPE: Analysis

PROPONENT: Defence Operational Analysis Establishment (DOAE)

POINT OF CONTACT: T R Howard, DOAE

PURPOSE:

The BGM is primarily used for anti-armour weapon mix comparisons, to assess the relative systems effectiveness against targets together with support systems.

DESCRIPTION:

Domain: Land.

Span: Represents combat at Battlegroup vs RED Regiment level. Can also be used at Battlegroup vs RED Company level.

Environment: Statistical representation of terrain. Cultural features must be taken into account by the scenario designer. Represents combat by day or by night dependant on data set.

Force Composition: Force composition is specified in terms of type and number of weapons in each weapon group, for BLUE and RED.

Scope of Conflict: Direct Fire engagements modelled explicitly. Limited representation of Indirect Fire and Air effects.

Mission Area: Conventional.

Level of Detail of Processes and Entities: Number of individual weapon systems represented. Infantry represented as sections. Weapons are grouped as specified in data base, and all weapons of one type within a group are treated as an entity for attrition calculations.

CONSTRUCTION

Human Participation: None.

Time Processing: Done implicitly within scenario "story-line".

Treatment of Randomness: Attrition deterministically based on Lanchester Coefficients.

Sidedness: Two-sided, symmetric model.

LIMITATIONS: Models only statistical terrain. No account taken of logistics. Perfect C^3 assumed.

PLANNED IMPROVEMENTS/MODIFICATIONS: Graphical interface for easier scenario development currently being added.

INPUT: Weapon characteristics and SSKPs. Scenario "story line" in terms of time/position/targets for engagement.

OUTPUT: Attrition and total casualty figures, and overall outcome of battle.

HARDWARE AND SOFTWARE

Computer: DEC VAX with VMS operating system.

Storage: 7400 blocks (3.7 megabytes) for executable code.

Peripherals: Minimum requirements, 1 VT terminal.

Programming Language: FORTRAN 77, DCL

Documentation: Extensively documented, with published user guide and papers explaining techniques used.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Users: DOAE and MINDEF Singapore.

TITLE: Battle Group War Game DATE IMPLEMENTED: 1958.

MODEL TYPE: Analysis.

PROPONENT: BGWG Section, CA4 Division, RARDE, Ft Halstead, Kent, England, U.K.

POINT OF CONTACT: I. S. Gardner, CA4, RARDE, Ft Halstead, Kent, U.K., 0959-32222, ext 2444.

PURPOSE: The game is a research and evaluation tool, dealing primarily with weapon systems development and effectiveness. It can also be used to assess force capability and requirements, dealing with courses of action, mix and effectiveness.

DESCRIPTION:
Domain: Land.

Span: Local.

Environment: Digitized terrain consists of data for each 100 meter square. Terrain features include spot heights, 3 types of vegetation, 2 types of building, rivers, roads, bridges and obstacles. The model can handle any time of day in any weather conditions.

Force Composition: Up to regimental level.

Scope of Conflict: Conventional.

Mission Area: Any conventional missions within the domain.

Level of Detail of Processes and Entities: The lowest entities modelled are fire teams and individual vehicles. Attrition, movement and target acquisition are modelled for each entity.

CONSTRUCTION:
Human Participation: Required for decisions and processes.

Time Processing: Processing is dynamic, the model uses time stepping.

Treatment of Randomness: The model is stochastic, it uses the Monte Carlo method.

Sidedness: The model is two-sided and symmetric.

LIMITATIONS: Does not model C3I in any detail, close combat and air/ground interactions are not modelled adequately.

PLANNED IMPROVEMENTS/MODIFICATIONS: None.

INPUT: Terrain data, weather data, system and weapon characteristics including attrition data, mobility data and activity timings.

OUTPUT: System status and acquisitions are printed during the game. Records of all direct fire and indirect fire events and mine encounters are recorded manually.

HARDWARE AND SOFTWARE:
Computer: Designed to run on a VAX computer with a VMS operating system.
Storage: 64 megabytes.
Peripherals: The minimum requirement is 1 printer and 2 VT series terminals.
Programming Language: VAX FORTRAN.
Documentation: There is a set of 4 manuals, including a user's guide.

SECURITY CLASSIFICATION: UNCLASSIFIED, data base classified secret.

GENERAL DATA:
Data Base: About 6 man-months per study.

CPU Time per Cycle: About 20 minutes of processor timer per minute of game time (on a VAX-785).

Data Output Analysis: Manual.

Frequency of Use: No longer in regular use.

Users: BGWG section CA4 Division in response to requests for studies by a series sponsor from within the MOD.

Comments: This game was originally totally manual, but became computer aided in 1980.

DATE IMPLEMENTED: 10/30/90

TITLE: C3ISIM

MODEL TYPE: Analysis

PROPONENT: Directorate of Combat Developments, Concepts & Studies Division, U.S. Army Air Defense Artillery School, Ft. Bliss, TX

POINT OF CONTACT: Fred Lohrman, USAADASCH, ATTN: ATSA-CDC-M, Fort Bliss, TX, 79916-0002

PURPOSE: C3ISIM is basically a many-on-many model designed to simulate the interaction of a multitude of C2 nodes, weapon systems, communications nodes, and intelligence sensors in an air defense and SRBM defense scenarios. It models both Blue and Red forces, and is designed to be graphics-based, user-oriented, highly versatile, and relatively low cost.

DESCRIPTION: C3ISIM is an effective and powerful tool for supporting the analysis of C3I systems and employment procedures. The arena of theater an tactical C3I has become enormously complex in recent years. With that complexity has come increasing difficulty in analyzing C3I system effectiveness, determining system impact on combat operations, and assessing the propriety of emerging operational concepts. C3ISIM helps both developers and potential users of new C3I systems to quickly, accurately, and inexpensively determine how well the design or specific employment of a system will fulfill operational requirements, by modeling the following functional areas:
- C2 processes through the use of rule-based decision making
- Combat engagements and many-on-many attrition in a dynamic, user-controled environment that fully exercises the C3I architecture
- Technical processes such as target detection, electronic warfare, and communications message flow

CONSTRUCTION: The C3ISIM model contains a number of processes that enable a user to create and store information on a wide variety of Blue and Red platforms. The types of platforms that can be represented range from major C2 nodes to individual weapon platforms. The actions that each platform can perform are controlled by a C2 ruleset. A ruleset is a group of software subroutines which manage the resources of a platform, carry out the platform's assigned role, and maintain its relationship with other platforms. Each platform is assigned its own ruleset. The model's ability to simulate technical processes (such as radar detection and radio transmission), C2 processes (C2 decision making and direction), and combat engagement processes (air-to-air, ground-to-air, etc.) in a single, dynamic user controlled environment places it at the forefront of present-day simulation tools.

LIMITATIONS: Fidelity, lack of available databases

PLANNED IMPROVEMENTS AND MODIFICATIONS: Ongoing upgrading

INPUT:
- Aircraft flight paths and profiles
- Scenario data (flight path timing and ground deployments for both Red & Blue)
- Communication networks

OUTPUT: High-resolution video simulation of the scenario participants and their actions. Each runtime process creates user specified data files during execution of a simulation in the form of ASCII and binary data files that can be manipulated and displayed or analyzed off-line at a later time.

HARDWARE AND SOFTWARE:

COMPUTER (OS): Silicon Graphics 4D-series workstation with UNIX v3.x operating system with Berkeley 4.3 enhancements.

STORAGE: Minimum disk storage depends upon user, but 760 Mb are recommended.

PERIPHERALS: A Personal Computer is recommended for further processing of output files; Printer with serial interface to print statisitcs reports

PROGRAMMING LANGUAGE: C-programming language

DOCUMENTATION: Tactical Missile Defense Extended Air Defense Simulation (TMD/EAD SIM) model Executive Summary, TMD/EAD SIM Methodology Manual, TMD/ EAD SIM User's Manual, TMD/EAD SIM Programmer's Manual.

OTHER COMMENTS: Commercial software applications are recommended to further manipulate output data; 32Mb RAM is recommended for large

SECURITY CLASSIFICATION: Model is UNCLASSIFIED, however, classification will be dependent upon the classification of database input to the model.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Most performance & parametric data is available in standard U.S. Government databases or reference documents; C3ISIM databases are TBD

CPU TIME PER CYCLE: A central European scenario with 400 platforms is about 1:1; with 1100 platforms changes to about 1:10

FREQUENCY OF USE: Daily

USERS: USAADASCH, USASDC, USAMICOM, USAASC, USACACDA, USATRAC, MISIC, U.S. Air Force, Teledyne Brown Engineering, CAS, DYNETICS

COMMENTS: Runtime varies greatly depending on hardware configuration, scope of scenario, and platform activity; it increases exponentially as the number of platforms increases.

TITLE: Campaign Model of Air Operations (CAMAO) DATE IMPLEMENTED: 1984

PROPONENT: LA2 Division, DOAE

POINT OF CONTACT: Dr R J Cherry, DOAE

PURPOSE: CAMAO is used primarily for theatre level assessments of new aircraft/munition systems and the way in which they may affect campaign strategy. It has also been used to provide lower level model with an assessment of likely levels of air activity throughout the campaign. CAMAO could be used to give military staff an overall view of tactics in an air war.

DESCRIPTION:

Domain: Air; limited ground interactions.

Span: 120 airbases, up to 5 Corps each for Blue and Red ground forces in each of two independent sectors.

Environment: High level, aircraft penetrate in corridors and hourly timesteps. Certain system performances can be varied by day or night.

Force Composition: Mixed raids (Offensive Counter Air, Escort, Defence Suppression and Reconnaissance) allowed.

Scope of Conflict: Primarily used at 2ATAF level, with a representative slice of WP opposing assets.

Mission Area: Most conventional missions with the exception Chemical and Nuclear.

Level of Detail of Processes and Entities: In the air, aircraft types and numbers - note aircraft are only 'flagged' to the extent of knowing their home airbase. Airbases and individual HAS and terminal defence numbers. For the ground forces divisional 'boxes' of defined size, together with an associated number of 'average radar SAMs' and an associated number of 'average non-radar SAMs'. Aircraft operations are determined by 'roling' policy - each aircraft type may have a given percentage in each of its possible roles. These 'roled' aircraft may then be apportioned to various areas of the battlefield as defined by input data.

CONSTRUCTION:

Human Participation: Required for decision making.

Time Processing: Hourly time steps.

Treatment of Randomness: Fully deterministic.

Sidedness: Two sided. Symmetric in Corps areas 1-4, Asymmetric in Corps 5, where Blue air defence airfields in that Corps are constrained to operate within Corps boundaries.

LIMITATIONS: Does not model the effect of the air war on the land battle. Of necessity much of the modelling is simplistic. In particular air-to-air combat has caused concern, but no better techniques have been proposed. No explicit EW other than an allowance for self-screening jamming. No representation of munition stocks other than Cruise (Ground or Air launched) or Ballistic Missiles. No modelling of air-to-air refuelling. Fuel stocks etc assumed sufficient.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Being adapted to allow user-friendly input of campaign decisions using graphics. Graphics display of campaign situation for Blue and Red players, also an umpire. This will allow interactive running to take place. Simplistic representation of AEW aircraft, stand-off and close-in jammers. Based heavily on adoption of OCA policy by both sides.

INPUT: Fixed movement of ground forces and associated air defences. Airbase names, defences, shelters and aircraft numbers. Weapon effectiveness. Detection and interception probabilities. Battle damage and Random fault factors. Aircraft allocations.

OUTPUT: Computer Printouts.

HARDWARE AND SOFTWARE:

Computer (OS): VAX 8650/VMS

Storage: Executable code requires 4100 blocks.

Peripherals: Minimum - 1 input terminal. In graphics version up to 3 x (Sigmex work station + mouse + VT220).

Programming Language: FORTRAN 77 (Run macro in DCL).

Documentation: High and low level available. Low level essentially a line by line description. All documentation held on tape for ease of printout/use/modification.

SECURITY CLASSIFICATION: Model unclassified.

GENERAL DATA:

Data Base: Preparation time depends on amount of low-level support available. Typically 18 man-months for an acceptable solution - would take many many years for perfect inputs.

CPU Time Per Cycle: Dependent on database size and player interactions. In automatic run-through typical time of 5 minutes for 5 days of war.

Data Output Analysis: Limited capability to draw graphs of certain Measures of Effectiveness.

Frequency of Use: Varies but is generally in use by one team or another continuously.

Users: Various study teams in LA2 division.

Comments: Has been used in several studies in the past, and has undergone several phases of development since original implementation date. Note also existence of simpler model - MINICAM (MINI CAMpaign model) - only two aircraft types, OCA and Offensive Air Support (OAS). Airbases represented in groups. Attrition due to all sources has to be calculated outside the model and remains constant throughout campaign - eg "Aircraft from Group 1 attacking Group 9 will suffer 10% attrition due to all causes". Has been used for doing range/payload studies for stand-off Missile systems. Because of its simplicity data can usually be agreed far more easily with customer than for CAMAO.

TITLE: Canadian Land Forces Training/Operational/Research War Game

DATE IMPLEMENTED: 1980's.

MODEL TYPE: Training, Operational and Research using manual gaming with computer rules off-line.

PROPONENT: Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), National Defence Headquarters, 101 Col By Drive, Ottawa, Ontario, Canada, K1A 0K2.

POINT OF CONTACT: Head, War Games Section, DLOR. (address above)

PURPOSE: The set of rules comprising the war game may be used in any of the above mentioned three roles. All games are manual with extensive computer support to assess outcomes of actions. The purpose is to model, with detail specific to the particular requirement, military situations which arise. As a research tool it deals with system effectiveness. As a training tool it is used both in team training and as an exercise driver for command post exercises. Each game may be played without computers by using manual look up tables.

DESCRIPTION: May be structured to meet sponsor requirements.
Domain: Land, Helo & F\W Air in support of ground forces.

Span: Regional.

Environment: Various, played on manual board.

Composition: Component elements, Blue and Red.

Scope: Conventional - special rule modules developed as required.

Mission Area: High and Medium intensity battlefield.

Level of Detail: Various, rule dependant, can play to individual weapon systems.

CONSTRUCTION:
Human Participation: Required for decisions and processes.

Time Processing: Dynamic, 5 minute game time steps.

Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, with one or more controllers.

LIMITATIONS: Requires experienced military gamers and computer operators all working from table top map of ground. The game can handle up to division level operations but is more suited to brigade and battalion operations.

PLANNED IMPROVEMENTS & MODIFICATIONS: As required for specific projects.

INPUTS: Weapons effects, orders of battle, scenario (from sponsor), organizations, tactics and orders.

OUTPUT: Various: Usually lists of current strengths, results of combat interactions, location, suppression, status, ammunition holdings, etc.

HARDWARE & SOFTWARE:
Computer: Now converted to PC DOS machines.
Storage: 20 MB Hard disk.
Peripherals: Printer.
Programming Language: Various, FORTRAN, Basic depending on modules used.
Documentation: DLOR Staff Note 89\16, "Program Description of the DLOR Computer Assisted War Game", by G. Buffington.

SECURITY CLASSIFICATION: UNCLASSIFIED without data.

GENERAL DATA:
Data Base: Various, weeks to months to complete.

CPU Time per Cycle: N/A.

Data Output Analysis: Almost instantaneous as instructions are input.

Frequency of Use: 3 to 5 times per year until 1988, now not used.

Users: Training: Staff Schools & Colleges, Brigades - Research: DLOR.

Comments: A flexible set of game rules which can be tailored to meet sponsor requirements.

TITLE: Cannon Row DATE IMPLEMENTED: 1986.

MODEL TYPE: Training and Education.

PROPONENT: Australian Army War Game Centre.

POINT OF CONTACT: Project Leader AWGC 62-2-9604411.

PURPOSE:
Analytical: No.

1. Research & Evaluation
   a. Weapons Systems
      Systems Development?
      Systems Effectiveness?
   b. Force Capability and Requirements
      Courses of Action Assessment?
      Mix?
      Effectiveness?
      Resource Planning
   c. Combat Development
      Current or New Doctrine?
      Competing Strategies?
      Policy Study?

2. Operational Support Tool (Decision Aid)
   a. Skills Development
      Team? yes
      Individual? no
   b. Exercise Driver
      Field Training Exercise Driver? No
      Command Post Exercise Driver? Yes
      Individual Exercise Driver? No

DESCRIPTION:
Domain: Land.

Span: Local.

Environment: Day or night. All weather conditions.

Force Composition: Combined forces, limited joint forces. Blue and Red.

Scope of Conflict: Primarily conventional warfare using conventional weapons.

Mission Area: Covers all conventional missions.

LEVEL OF DETAIL OF PROCESS AND ENTITIES:
Entity: Individual weapon to brigade.

Process: Attrition of weapons and personnel based on individual kills. The probability of a kill is based on weapon characteristics, size of formations/units and postures.

CONSTRUCTION:

Human Participation:

(1) Required:
- (a) For Decisions? Yes
- (b) For Process? Required for movements
- (c) For Both?

(2) Not Required:
- (a) Interruptable?
- (b) Scheduled Changes?
- (c) Not permitted?

Time Processing:

(1) Dynamic:
- (a) Time Step? Yes. All events occur within a game discrete game turn.
- (b) Event Step? No
- (c) Closed Form? No

(2) Static:

Treatment of Randomness:

(1) Stochastic:
- (a) Direct Computation? Yes
- (b) Monte Carlo? No

(2) Deterministic:
- (a) Generate a value as a function of an expected value?
- (b) Basically Deterministic (No randomness)?

Sidedness:

(1) One-sided?

(2) Two-sided:
- (a) Symmetric?
- (b) Asymmetric
  - One side non-reactive?
  - Both sides reactive? Yes

(3) Greater than two-sided:
- (a) Symmetric?
- (b) Asymmetric
  - One or more side non-reactive?
  - All sides reactive?

LIMITATIONS: Land warfare only. Climatic conditions based on Australian Environment (requires modifications for other locations). Requires modifications for additional weapon types.

PLANNED IMPROVEMENTS/MODIFICATIONS: Attack rules are being enhanced. A personnel/equipment data base is being added to provide a breakdown of casualties by type and injury description.

INPUT: Unit posture and size, Weapon type, ammunition type, range.

OUTPUT: Results are displayed but may be optionally printed. Results may be stored for future analysis.

HARDWARE AND SOFTWARE:
Computer (OS): IBM PC AT/XT or compatible using MS DOS 3.2.
Storage: Limited game on 360k disk. Full game on 1.2Mb disk. When data base implemented 20Mb disk.
Peripherals: Optional Printer.
Programming Language: Borland Turbo Pascal Version 5.
Documentation: Manuals available.

SECURITY CLASSIFICATION: Restricted.

GENERAL DATA:
Data Base: Not applicable.

CPU Time Per Cycle: Not applicable.

Data Output Analysis: No computerized analysis.

Frequency of Uses: More than 20 times per year.

Users: All units and training establishments.

Comments: Requires minimal set up. Board is required.

TITLE: CCDECSIM

DATE IMPLEMENTED: Proposed date for first version - July 1991.

PROPONENT: CA4 RARDE.

POINT OF CONTACT: Mrs. J. Saunders, (PO/BGWG CA4) RARDE, Fort Halstead.

PURPOSE: The game/simulation is being developed to provide a facility to evaluate and compare the effectiveness of small arms. It will be able to run either as a Wargame or as a Simulation. CCDECSIM is still under development.

DESCRIPTION: CCDECSIM is a model that deals primarily with the Close Combat Battle and is designed to assist in the operational analysis of weapon systems within company level scenarios. It is intended to run either as a simulation or as a closed interactive game where two players may control the opposing forces. It is an event sequenced stochastic simulation based on terrain of 10m resolution covering an area of up to 5km x 5km. Men and vehicles will be represented as individual units who are able to move and fire independently but will also be able to be tasked as groups. A maximum of 100 units per side can be presented.

INPUT: Weapon characteristics (lethality, accuracy, response time, etc.); Movement routes and speeds; ORBATs; Scenarios; Terrain Characteristics; Details of Equipment.

OUTPUT: DETAILED LOG OF ALL EVENTS.

HARDWARE AND SOFTWARE: 2 VAX station 3100 systems (GPX VAX station compatible); VWS VAX windowing software; PASCAL.

USERS: CA4 RARDE.

ADDITIONAL INFORMATION: The simulation/wargame is still under development. It is envisaged that the first version will be completed June 1991. Further developments will then be undertaken as required.

DATE IMPLEMENTED: 01/01/88

TITLE: Chemical Casualty (CHEMCAS)

MODEL TYPE: Analysis

PROPONENT: U.S. Army Chemical School, Fort McClellan, AL 36205-5020

POINT OF CONTACT: CPT Kierzewski, ATZN-CM-CC, AV 865-4111/3307/3174
U.S. Army Chemical School, Fort McClellan, AL 36205-5020

PURPOSE: CHEMCAS is an analysis model used to evaluate chemical weapon systems effectiveness against personnel targets. Primary uses in the past included producing weapons effects tables for FM 3-10-2 and assessing the expected battlefield hazard from enemy chemical attacks.

DESCRIPTION: CHEMCAS is a stochastic, one-sided, chemical casualty and hazard area assessment model. Using individual munition footprints from transport and diffusion models, CHEMCAS overlays these footprints on a target area and predicts casualties and contamination on the target. For each type munition, CHEMCAS considers errors in target location, Mean Point of Impact (MPI), and round-to-round ballistic dispersion. CHEMCAS does not consider terrain explicitly but the terrain does affect the footprints that CHEMCAS uses.

CONSTRUCTION: Once the input streams are specified and execution start human intervention is not allowed. The model is dynamic in that it portrays the effects of agent for user specified time intervals and considers the effects from rounds that arrive on the target at differing times. Using bivariate random errors, CHEMCAS generates random impact points then overlays the munition footprints on the target and accumulates the dosages and depositions. CHEMCAS is one-sided and can consider multiple targets and fire units but this capability has not been exercised recently.

LIMITATIONS: Fireplanning done off-line. One route of entry for the chemical agent.

PLANNED IMPROVEMENTS AND MODIFICATIONS: PC version with integrated graphics is planned. Also integration of graphics into the mainframe version.

INPUT: Weapon parameters such as, agent fill and dissemination characteristics, ballistic errors, and aiming procedures. Environmental conditions to include windspeed, temperature, and stability. Target area size, orientation.

OUTPUT: Computer printouts with raw data, statistics, and analyzed data.

HARDWARE AND SOFTWARE:

COMPUTER (OS): UNYSIS 1100/70 OS 1100

STORAGE: 1 Meg memory (to run either main program or NUSSE3 cloud generator), 3.8 Meg disk.

PERIPHERALS: Line printers

PROGRAMMING LANGUAGE: ASCII FORTRAN

DOCUMENTATION: Written by SAIC Feb 88; never published.

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 1 hr for normal runs (one type of munition)

CPU TIME PER CYCLE: 5 min

DATA OUTPUT ANALYSIS: Upper and lower confidence levels, expected values.

FREQUENCY OF USE: Quarterly.

USERS: USACMLS

COMMENTS: Currently linked to NUSSE3 transport and diffusion model. Will use NUSSE4 when that model becomes available.

TITLE: Combat Analysis Sustainability Model - CASMO

MODEL CATEGORY: Analysis (Logistics).

PROPONENT: U.S. Army Concepts Analysis Agency, Attn: Force Systems Directorate, 8120 Woodmont Avenue, Bethesda MD 20814-2797.

POINT OF CONTACT: Dong S. Kim, AV 295-1652/(301) 295-1652

PURPOSE: CASMO is used to analyze division level operations of maintenance and logistics support in peace or war time. It is designed to serve as both an operations support and a capability assessment of major weapon systems to meet mission requirements.

DESCRIPTION: CASMO is a stochastic, event-step simulation model representing the operation of maintenance and logistic support within Army Divisions. CASMO is designed to assess the capability of U.S. Army combat units and their supporting maintenance and logistics organizations to: (1) maintain and repair weapon systems, (2) reorder spare parts, and (3) perform other maintenance and logistics support functions under a variety of operational environments.

Domain: Land.

Span: Accommodates any division in a theater depending on data base.

Environment: Cartesian Coordinate based, all terrain. Models shifts in day and night, peace and war time, combat postures.

Force Composition: Any type of division, Blue and Red.

Scope of Conflict: Conventional warfare, conventional weapons excluding fixed wing aircraft for maintenance repair.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: Models company level, resolution to bumper number of weapon systems, man-hours of MOS, service equipment and spare parts by NSN, fuel in gallons, ammunition in rounds.

CONSTRUCTION:

Human Participation: Human participation is not required during simulation. Decisions are made at input.

Time Processing: Dynamic, Time and event step model. Progress through events during a given combat cycle time period.

Treatment of Randomness: Scheduled and unscheduled maintenance requirements are randomly selected at each failure. All vehicles have assigned bumper numbers and vehicles are assigned for maintenance by random selection of bumper numbers. Selection of damaged part for combat maintenance is a random process. CASMO uses delay distribution for several types of time delays. Time delays range from deterministic delays to stochastic delays and include most of the traditional probability distributions. These are Deterministic, Exponential, Uniform, Normal, Log-normal, Gammer, Weibull and Empirical distributions.

Sidedness: Two-sided but operations of logistics supports for only the blue side.

LIMITATIONS: Fixed wing aircraft weapon system is not modeled. Attrition of maintenance system and repair personnel are not modeled. Supply trucks are not modeled, though delay distributions are used.

PLANNED IMPROVEMENT/MODIFICATIONS: Rotary wing weapon system (Helicopters) will be modeled.

INPUT: CASMO requires three categories of input data to complete sustainability analysis. These are: (1) scenario data that include weapons and ammunition to be modeled, combat unit and maintenance unit organization, and resources of maintenance unit, (2) unit action data that define battery or company maneuvers and combat action during the simulated engagements, and (3) combat damage data that determine how many combat "hits" each blue weapon system receives. Combat damage data is combined with shotline data derived from the Sustainability Prediction for Army Spare Components Requirements for Combat (SPARC) to generate a list of parts damaged for repair.

OUTPUT: CASMO produces two types of outputs including a summary report and a detailed historical event file. The summary report contains two categories of information, namely, queuing statistics and maintenance resources utilization statistics. The summary report is designed to present summary information useful to three types of users: (1) a maintenance decision maker, (2) a supply decision maker and (3) an operational decision maker. The summary report contains MOS utilization per shift, maintenance throughput, utilization of equipment/recovery vehicle/contact vehicle, deferred maintenance actions, parts status, number of back orders, fuel/ammunition supply data, number of type weapon systems down, and availability of weapon systems.

HARDWARE AND SOFTWARE:
Computer(OS): VAX 11/780, VAX 8600 (VMS).
Storage: 6 Mb.
Programming Language: SIMSCRIPT, FORTRAN.

Documentation: Analyst Guide, User Training Manual. Adequately documented.

SECURITY CLASSIFICATION: Programs are UNCLASSIFIED, input data are classified.

GENERAL DATA:

Data Base: Data base must be developed for type of weapon systems modeled. Once the data base has been developed, a large portion of data may not need to change for each study unless there is a need to model a new weapon system.

Time Requirements: 24 weeks (for preparation, run and analysis).

Frequency of Use: Plans 2 studies per year.

Users: OTEA, CAA.

TITLE: Combat Identification System COMO Integrated Air Defense (CISCIAD) Model

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command - White Sands (TRAC-WSMR)
White Sands Missile Range, NM 88002-5502

POINT OF CONTACT: Mr. Bill Garrett, USATRAC-WSMR, ATRC-WBC, White Sands Missile Range, NM 88002-5502; DSN 258-2307/3668

PURPOSE: CISCIAD is used primarily for system level effectiveness studies of tactical air defense systems. It is also appropriate for mission planning analysis, employment/deployment analysis, force structure evaluations, firing doctrine development, battle management algorithm development and evolutionary concept evaluation.

DESCRIPTION: CISCIAD simulates large scale battles between air defenders and an air threat in a conventional environment. It is usable up to Theater level and typically portrays joint forces. The model represents the functional activities of the defenders and the threat as they interact with each other and the environment. A digitized terrain data base is used to depict the terrain relief as well as cultural features of the battlefield. The effects of environmental factors and counter measures are simulated.

The level of detail which is modeled for entities and processes is typically at the individual system level and sometimes at the sub-system level. The entities simulated include air defense missile and gun systems interceptor aircraft, defense suppression and penetrator aircraft, helicopters, early warning and tracking radars, combat identification systems, command and control element, communication links, tactical ballistic missiles, cruise missiles, jammer and escort aircraft, air bases, airspace weapons control volumes, and defended assets.

CONSTRUCTION: CISCIAD is a two-sided symmetric model using dynamic event step time processing. It is stochastic/Monte Carlo and neither requires nor permits human participation or interruption during execution.

LIMITATIONS: The maximum number of fire units and aircraft that can be played are 300 and 1024 respectively. Nuclear & chemical warfare & total logistics are not currently modeled. There is no ground-to-ground combat.

PLANNED IMPROVEMENTS AND MODIFICATIONS: When time permits, a graphical package will be developed to assist and speed scenarios generation and analysis results. Package will relate to analyst workstation.

INPUT: Threat and friendly aircraft characteristics and vulnerabilities; SHORAD system characteristics; HIMAD system characteristics; Aircraft flight paths and profiles; Command and Control element characteristics; ECM jamming data; Combat identification system data; Visibility data for HIMAD and SHORAD positions.

OUTPUT: Computer printout of RED and BLUE kills, time of kills, detection ranges, engagement ranges, kill ranges, killer-victim scoreboards, aircraft identification proficiency of movement, etc. Graphics playback of movement, engagements, and kills.

HARDWARE AND SOFTWARE:

COMPUTER (OS): UNISYS 1192, VAX (VMS), CRAY, IBM, HP 9000 (UNIX)

STORAGE: 25K - 150K words (scenario dependent)

PERIPHERALS: Disk storage and printer. Color Graphics: RAMTEK

PROGRAMMING LANGUAGE: FORTRAN 77 (FORTRAN 8x for UNISYS)

DOCUMENTATION: VEDA Report Number 103292-86U/P1035 Program Specification, 17 Feb 87; VEDA Report Number 103066-87U/P1035 User's Manual, 6 May 87, General Research Corp CR-2-985 A COMO Integrated Air

OTHER COMMENTS: DOCUMENTATION CONTINUED: Defense Model with Command and Control, Apr 81.

SECURITY CLASSIFICATION: UNCLASSIFIED code.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Scenario dependent but usually between 2 and 6 months.

CPU TIME PER CYCLE: Battle time/cpu time = 1 for medium sized scenario on HP 9000/600 (15 MIP machine).

DATA OUTPUT ANALYSIS: Post processor cpu time = 5 min on HP 9000/600

FREQUENCY OF USE: Continuous.

USERS: TRAC-WSMR, CAA, USAADASCH

COMMENTS: Government agencies can obtain CISCIAD with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of CISCIAD can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or calling AV 552-5511 or commercial 913-684-5511.

TITLE: Combat Prescribed Load List Model - Combat PLL Model

DATE IMPLEMENTED: 1984.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity (AMSAA), Inventory Research Office (IRO), 800 U.S. Custom House, 2nd and Chestnut Streets, Philadelphia, PA 19106-2976.

POINT OF CONTACT: Marty Cohen/Meyer Kotkin, DSN 444-3808/09 or (215) 597-8377.

PURPOSE: The Combat PLL model is used by the Army Materiel Command (AMC) to compute Mandatory Parts Lists (MPLs). The MPLs are minimum stockage quantities needed to support an organization in a specified combat environment. The model is an analytic model which uses the theory associated with S-1, S continuous review inventory systems with Poison demands. It computes the minimum cost stockage needed to achieve a target for the average number of equipment operating in the 15 most intense days of combat. Stockage for each end item is computed separately. Common parts need to be rolled up by the user.

DESCRIPTION:

Domain: Land and air.

Span: Computes stockage for organizational level of repair.

Environment: Controlled by wartime usage rates which are developed outside model.

Force Composition: Blue forces.

Scope of Conflict: Controlled by wartime usage rates.

Mission Area: Provide stockage requirements for the first 15 days of combat.

Level of Detail of Processes and Entities: Calculates PLL level demands.

CONSTRUCTION:

Human Participation: Not required nor permitted while model is running.

Time Processing: Dynamic, time and event stepped model.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Cannibalization is a not played in the model. The Poison demand process is not dependent on the number of operating end items. Direct support supply is assumed available in an Order Ship Time (OST) with a know probability.

PLANNED IMPROVEMENTS AND MODIFICATIONS: To be determined based on need.

INPUT: Candidate Item File (CIF) which identifies the parts used on a given end item along with, for each part, mean usage between removal of the part, the removal task distribution, line replacement unit code, and unit price. End item identification and densities. Mission profile with 15-day expected usage for the end item for various measures of usage.

OUTPUT: Stockage list for each end item at each density. Expected average NMCS during 15 days of intense combat.

HARDWARE AND SOFTWARE:
Computer: Runs on a GOULD computer with a UNIX operating system but can be easily modified for other computers.
Storage: Not significant.
Peripherals: Minimum requirement is 1 VT100 terminal.
Programming Language: FORTRAN.
Documentation: Documented.

SECURITY CLASSIFICATION: UNCLASSIFIED, but data may be classified.

GENERAL DATA:
Data base: Varying, depending on data.

CPU Time per Cycle: Varying, depending on applicability of existing data.

Data Output Analysis: Varying, depending on desired end product.

Frequency of Use: Used several times per year by those listed below.

Users: AMSAA, AMC Major Subordinate Commands (MSCs), and MRSA.

Comments: Combat Authorized Stockage List (ASL) Model handles similar data at direct support level of maintenance.

Releasability: Releasable.

TITLE: Combat Sample Generator - COSAGE V

DATE IMPLEMENTED: 1980.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Mr. John Warren, (AV) 295-1690/(301) 295-1690

PURPOSE: COSAGE is a computerized combat assessment/weapons effectiveness model which develops information on ammunition expenditures and losses of personnel and equipment during a 24 to 48-hour period of combat. The principal application is the forecasting of personnel, ammunition, and equipment requirements.

DESCRIPTION:

Domain: Land and air.

Span: Division area of operations.

Environment: When terrain parameters are required, the model randomly selects a terrain type based on statistical analysis of the region of interest. These parameters are then used to determine line of sight, movement rates, etc. Night and day are modeled, and visibility varies by time of day.

Force Composition: Combined arms army, including helicopters and close air support.

Scope of Conflict: Conventional warfare.

Mission Area: Most of the mission areas associated with conventional combined arms are represented, with the exceptions of logistics and intelligence.

Level of Detail of Processes and Entities: Maneuver unit resolution is typically down to Blue platoons and Red companies. In the case of close combat, resolution is to the level of individual equipment or personnel and their weapons, with each direct fire shot modeled explicitly.

CONSTRUCTION:

Human Participation: None.

Time Processing: Dynamic event step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Electronic, biological, chemical, and nuclear warfare are not modeled, nor military operations in built-up areas. Logistics and intelligence functions are not represented.

PLANNED IMPROVEMENTS/MODIFICATIONS: No major improvements are planned.

INPUT: Unit organizations, strength, and weapons; orders for each maneuver unit; weapons data (single shot probability of kill, lethal area); sensor capabilities; terrain parameters; movement rates; artillery organization and characteristics.

OUTPUT: Killer-victim scoreboard, personnel losses, ammunition expenditures by shooter/target combination, materiel losses, and unit locations on plot by time.

HARDWARE AND SOFTWARE:

Computer (OS): UNISYS 1100 series, with Exec 8. Has also been installed on various machines with UNIX operating systems.

Storage: 420K words of memory for model and data.

Peripherals: Line printer. CALCOMP plotter, if plots are desired.

Programming Language: SIMSCRIPT II.5

Documentation:

- Combat Sample Generator User's Manual, DTIC B070095L
- Combat Sample Generator Program Maintenance Manual, DTIC B073013L

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:

Data Base: 6 man-months required to acquire data, plus 3 man-months required to structure data in model input form.

CPU Time Per Cycle: 90 minutes on UNISYS 1100.

Data Output Analysis: 1 month.

Frequency of Use: Support for ten to fifteen studies a year.

User: U.S. Army Concepts Analysis Agency.

Comments: COSAGE is linked to the following models: FORCEM (Force Evaluation Model), CEM (Concepts Evaluation Model), WARF (Wartime Replacement Factors), and WARS (Wartime Ammunition Rates System).

TITLE: COMBAT-SIM DATE IMPLEMENTED: 1986.

MODEL TYPE: Training and Education.

PROPONENT: Australian Army War Game Centre.

POINT OF CONTACT: Project Leader AWGC 62-2-9604411.

PURPOSE:
Analytical:
1. Research & Evaluation
   a. Weapons Systems
      Systems Development?
      Systems Effectiveness?

   b. Force Capability and Requirements
      Courses of Action Assessment?
      Mix?
      Effectiveness?
      Resource Planning

   c. Combat Development
      Current or New Doctrine?
      Competing Strategies?
      Policy Study?

2. Operation Support Tool (Decision Aid)
   a. Skills Development

Team?	Yes
Individual?	No

   b. Exercise Driver

Field Training Exercise Driver?	No
Command Post Exercise Driver?	Yes
Individual Exercise Driver?	No

DESCRIPTION:
Domain: Land.

Span: Regional/local.

Environment: Day or night. Full range of weather. Terrain (height, slope, vegetation).

Force Composition: Joint and Combined Forces. Red and Blue.

Scope of Conflict: Conventional.

Mission Area: All conventional missions.

Level of Detail of Process and Entities:
Entity: Section/squad up to company.

Process: Intervisibility, movement detection, attrition, generation of casualties (battle and non-battle), ammunition and fuel usage.

CONSTRUCTION:

Human Participation:

(1) Required:
- (a) For Decisions? Yes. (System continues to run)
- (b) For Process? No
- (c) For Both?

(2) Not Required:
- (a) Interruptable?
- (b) Scheduled Changes?
- (c) Not permitted?

Time Processing:

(1) Dynamic:
- (a) Time Step? Real time
- (b) Event Step? No
- (c) Closed Form? No

(2) Static:

Treatment of Randomness:

(1) Stochastic:
- (a) Direct Computation? Yes
- (b) Monte Carlo? No

(2) Deterministic:
- (a) Generate a value as a function of an expected value?
- (b) Basically Deterministic (No randomness)?

Sidedness:

(1) One-sided?

(2) Two-sided:
- (a) Symmetric?
- (b) Asymmetric
  - One side non-restrictive?
  - Both sides reactive? Yes

(3) Greater than two-sided:
- (a) Symmetric?
- (b) Asymmetric
  - One or more side non-reactive?
  - All sides reactive?

LIMITATIONS: Maximum of 384 units. Maximum of a 2 Battalion Brigade scenario.

PLANNED IMPROVEMENTS/MODIFICATIONS: Increase the number of stations to allow for more than 2 Battalion Brigades. Increase the number of units to be modelled.

INPUT: Scenario, unit characteristics, weapon characteristics, terrain characteristics.

OUTPUT: Report printouts, Video map with graphics overlay.

HARDWARE AND SOFTWARE:
Computer (OS): IBM PC AT MS DOS 3.2. Ten stations networked
Storage: 20MB disk per station (more preferred)
Peripherals: Laser video disk, graphics overlay device, printers, joy stick.
Programming Language: MODULA 2.
Documentation: Draft.

SECURITY CLASSIFICATION: Restricted.

GENERAL DATA:
Data Base: 3 man days.

CPU Time per Cycle: Not applicable.

Data Output Analysis: No.

Frequency of Uses: 12 times per year.

Users: Battalions/Brigades, Advanced Officer Courses.

DATE IMPLEMENTED: 01/01/90

TITLE: Combined Arms and Task Force Evaluation Model (CASTFOREM)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Center - White Sands Missle Range (TRAC-WSMR), WSMR, NM 88002

POINT OF CONTACT: Carrol R. Denney, TRAC-WSMR, Bldg 1401, White Sands Missile Range, NM 88002 AV 258-3029 Commercial 505-678-3029

PURPOSE: CASTFOREM is the lowest echelon, highest resolution, systemic combat simulation model in the family of Army Model Improvement Program's (AMIP) family of computer simulation, force-on-force models. Its primary function is as an analysis tool used to select between competing weapon systems in a COEA process. It is also useful to examine and/or develop tactics, and for parametric analysis on various weapon system performance parameters.

DESCRIPTION: CASTFOREM is a stochastic, event-sequenced, opposing forces simulation of ground combat involving up to an attacking brigade force and against a defending reinforced regiment. Although not artificially constrained by programming considerations, practical limitations of computer run time and complexity of analysis would dictate that the above force sizes be considered maximum and that battle times be constrained to firefights of ninety minutes or less. The model is used in a fully automated (batch) mode with resolution down to the individual weapon system level. The battle is fought on a digitized representation of the terrain which may vary in resolution. Realistic battle conditions are further simulated by the modeling of static weather, dynamic obscurants (smoke and dust), nuclear and chemical contaminants, implicit electronic warfare, explicit communications (message passing, delays, and networks), terrain constrained movements, movement in formation, detailed search and detection, and realistic command and control acheived by the use of decision table methodology. Close air support, helicopters, air defense, engineering services, fire support, close combat, and combat service support are modeled in sufficient detail to support the combined arms conflict.

CONSTRUCTION:
- Human Participation: Not required -- Fully automated simulation.
- Time Processing: Dynamic, Event stepped.
- Treatment of Randomness: Stochastic.
- Sideness: Two sided symmetric.

LIMITATIONS: RAM is not explicitly represented except for missiles. Weather is static throughout the duration of the game; EW is generally implicit except for jamming red radars.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improvements and modifications are driven by study requirements.

INPUT: Terrain description parameters; Environment parameters; Weapons effects data; Weapon system descriptions; Unit orders; Decision tables; Organizational structures; CS and CSS equipment data; Communications data and network structures; Tactical Areas descriptors; Sensor data; Maneuver network structure; Unit description data; Output directives.

OUTPUT: Each event specified by the output descriptors is recorded for postprocessing; An extensive and comprehensive set of post processing routines is availabe with the model. Graphical playback is also available.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX Series running VMS; SUN RISC machines running UNIX; HP 900 series running UNIX; Others.

STORAGE: Computer main memory should be at least 32 megabytes on the VAX machines and 64 megabytes on the UNIX based machines.

PERIPHERALS: Disk storage should be at least 300 megabytes; cartridge or reel tape;

PROGRAMMING LANGUAGE: SINSCRIPT II.5 and FORTRAN.

DOCUMENTATION: Available in six volumes and annually updated are: Executive Summary; User's Input Guide; Post-Processor's Users Guide; Methodologies Manual; Scenario Writer's Guide; V&V Manual.

OTHER COMMENTS: Configuration control is tightly controlled by TRAC Model Control Policy. User Group meets periodically.

SECURITY CLASSIFICATION: The Model, itself, is UNCLASSIFIED, however, some input data may be classified.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Setup and data acquisition times vary according to scenario, previous model usage and experience. 2 weeks to 4 months.

CPU TIME PER CYCLE: Variable. Smallest scenarios run at 5 minutes/rep while largest run up to 4 hours per rep; Average cpu/battle = 1.75/1.00

DATA OUTPUT ANALYSIS: Variable. Large studies normally require 2 to 3 months.

FREQUENCY OF USE: Daily at TRAC-WSMR, Variable at other installations.

USERS: TRAC, Armor School, FISTC, ARDEC, SMO, MICOM, DARPA, and limited Army Contractors.

COMMENTS: Government agencies can obtain CASTFOREM with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of CASTFOREM can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS, 66027-5200 or call AV 552-5511 or commercial 913-684-5511.

DATE IMPLEMENTED: 10/26/90

TITLE: COMO-T

MODEL TYPE: Analysis

PROPONENT: Directorate of Combat Developments, Concepts & Studies Division, U.S. Army Air Defense Artillery School, Ft. Bliss, TX

POINT OF CONTACT: Manuel Amaro, USAADASCH, ATSA-CDC-M, FT BLISS, TX 79916-0002, AV 978-2304/1238

PURPOSE: To simulate air defense war games from one-on-one engagements to theater force level.

DESCRIPTION: COMO III is a computerized, two-sided, analytical damage assessment/weapon effectiveness model. COMO-T is the machine transportable version of COMO III and runs on DEC VAX and UNIVAC computers a framework for the construction of system-level simulations of tactical an strategic weapon systems in a modular and mutually compatible form. The COMO frame, when assembled with FORTRAN weapon decks which describe the interacting systems, form a critical event-stepped Monte Carlo simulation. It is flexible as to game size and input/output format and is extra efficient in memory use.

CONSTRUCTION: Simulation consists of a FRAME, a combination of WEAPON decks (Red and Blue), and a user supplied scenario (Timing, A/C Tracks, RVIS).

LIMITATIONS: May be long turnaround time dependent upon machine/scenario Model is manpower intensive in setup time and output data reduction; Run time increases nonlinearly with number of aircraft in scenario.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Dynamic line of sight (DLOS) is in the process of being implemented.

INPUT:
- Threat aircraft characteristics and vulnerabilities
- ADA system characteristics (weapons decks)
- Aircraft flight paths and profiles
- Scenario data (flight path timing and ground deployments)
- Threat munition characteristics
- ECM jamming levels

OUTPUT:
- Computer printout with input data, kill summary, and specialized statistics on a per-site/per-aircraft basis
- Data tape for extensive post-processing at a later time

HARDWARE AND SOFTWARE:

COMPUTER (OS): MicroVAX 3500 with VMS Operating System

STORAGE: 2-RA70 280 Mb disk drives
2-ADS 1.2 Gb disk drives

PERIPHERALS: 1-TU81 1/2" MAG Tape Drive; 1-TK50-70 Tape Cartridge Drive; 1-Decwriter III System console; 1-C. ITOH 400 lpm printer; 7-user t

PROGRAMMING LANGUAGE: FORTRAN

DOCUMENTATION: Programmers Reference Guide and Users Manual for each of the weapon decks and the COMO Input Language (COMIL)

OTHER COMMENTS: None

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 2-3 days for RVIS; 2-5 hrs for DLOS

CPU TIME PER CYCLE: 1-5 minutes for small scenarios

DATA OUTPUT ANALYSIS: Dependent on study

FREQUENCY OF USE: 3-4 major & 6-8 minor studies/year

USERS: USAADASCH

TITLE: Concepts Evaluation Model - CEM

DATE IMPLEMENTED: 1974.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797

POINT OF CONTACT: William T. Allison, (AV) 295-5236

PURPOSE: CEM is used primarily to analyze force effectiveness at theater level warfare. It is designed to provide a tool to assess the effectiveness of different mixes of forces and resources and to estimate ammunition, equipment, and personnel requirements.

DESCRIPTION:

Domain: Land and Air.

Span: Accommodates any theater given a data base; has been used for Korea, Southwest Asia, and Central Europe.

Environment: Terrain consists of three types representing good cross country maneuverability, marginal cross country maneuverability and road bound. Natural and man-made barriers are also represented. Terrain is described in rectangular bands. Each 12-hour division level cycle represents average proportion of day and night. No weather.

Force Composition: Combined forces for Blue and Red.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions except unconventional warfare.

Level of Detail of Process and Entities: Simulates command decisions at four levels from theater to division. Force inputs as Blue brigade and Red division. Combat occurs between Red divisions and Blue brigades along a continuous FEBA. Accommodates up to 70 Blue and 125 Red divisions with up to 51 types of weapons. Aircraft are aggregated into two types; Air Defense Fighters and Tactical Fighters. The latter are given daily missions of Counter Air (CA), Armed Recon/Interdiction (AR/I), or Close Air Support (CAS). Attrition to CA and AR/I are probability of kill. Attrition to CAS and divisional personnel and equipment is derived from results of a high resolution simulation used to extrapolate for the actual weapons in the CEM engagements. Logistics are highly aggregated. Movement of FEBA is a function of attacker and defender final to initial combat worth ratios.

CONSTRUCTION:
Human Participation: None. Fully automated.

Treatment of Randomness: A deterministic expected value combat simulation.

Time Processing: Time step based on a 12-hour division level cycle.

Sidedness: Two-sided, symmetric model.

LIMITATIONS: Does not model breakthrough, airborne assaults, engineer functions, transportation, lines of communication, electronic, chemical, or nuclear warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Different combat attrition samples for night and day; deep fires against second echelon and arriving forces; combat attrition of GS artillery.

INPUT: Terrain map; troop lists; TOEs (personnel, ammo, POL, other supplies, tanks, APCs, helicopters, anti-tank missiles, and artillery); shooter-target results from high resolution simulation; resupply and replacement rates (personnel, ammo, POL, other supplies, and weapons); arrival schedule for resupply, reinforcing artillery battalions, and maneuver units; and FEBA movement tables.

OUTPUT: Computer reports stating (periodic) FEBA locations, posture profiles, state of opposing forces, resources expended, KIA, WIA, CMIA, and DNBI; and weapons hit, destroyed, damaged, abandoned, and repaired. Graphic (plotter or color CRT) display of same results.

HARDWARE AND SOFTWARE:
Computer: UNISYS 1100/84; CRAY XM-P/48; CRAY II.
Storage: 1.2 million decimal words.
Peripherals: Two tape drives or disks; one printer.
Programming Language: ASCII FORTRAN.
Documentation: CAA-D-85-1, Volume I, Technical Description, January 1985 (Revised October 1987); CAA-D-85-1, Volume II, Users' Handbook, August 1985. (Revised January 1990).

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: Acquisition - 2 months; Preparation - 18 man-months.

CPU time per Cycle: UNISYS 1100/84 - 36 hours (for 180 days simulation); CRAY XM-P/48 -4 hours (for 180 days simulation).

Data Output Analysis: 2 months.

Frequency of Use: 800 times per year.

Users: U.S. Army Concepts Analysis Agency.

Comments: CEM is dependent on results from a higher-resolution division model (presently COSAGE) for combat attrition and munition expenditures.

TITLE: Contingency Force Analysis Wargame - CFAW

DATE IMPLEMENTED: N/A.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, Attn: (CSCA-SPC) 8120 Woodmont Avenue, Bethesda, MD 20814-2797

POINT OF CONTACT: Mr. Robert Hart, (301) 295-1574/(AV) 295-1574.

PURPOSE: CFAW is used primarily to examine both operation plans and contingency plans and to analyze potential conflict.

DESCRIPTION:
Domain: Land, Air, and over-the-shore naval operations.

Span: Scale depends on specific study needs. Reasonable span ranges from division to small theater.

Environment: Hex-based. Each hex edge incorporates 1 of 10 possible types of road and off-road trafficability factors. Each hex is one of seven terrain types, which include mountains, hills, null, flat, swamp, urban, and water. Hex size is an input parameter; the current model can employ four 49x49-hex maps. Weather, time of day, and day and night are modeled.

Force Composition: Combined and joint forces can be modeled.

Scope of Conflict: Conventional conflict with rear area and noncontiguous FLOT. Nuclear and chemical play is limited to initial effects (no effects of contamination, persistence, collateral damage, etc.).

Mission Area: Air (DCA, CAS, BAI), direct and indirect fire (including TBM and rockets), air defense, airlift (including airborne and airmobile), and barrier operations are represented.

Level of Detail of Processes and Entities: Land combat units can be modeled from company to division as discrete entities with brigade/regiment being the preferred entity size. Units are collections of direct and indirect fire weapon types, each having a descriptive data base of acquisition and kill probabilities, fire distribution, and other input parameters. Attrition on units in direct fire combat is adjudicated by a differential equation. Equation parameters are obtained from a detailed, Monte Carlo simulation model. Attrition varies with posture and terrain. Combat is initiated by attack by an aggressor unit and terminated upon player command or by breaching a player specified attrition threshold. Model is a single-echelon command and control; players must give orders to each unit played for movement. Air units are modeled as squadrons of individual aircraft that can be given ground attack, defensive counter-air, or escort missions.

CONSTRUCTION:

Human Participation: Required for all unit mission and movement decisions.

Time Processing: Dynamic, Time-step. Game time to real time is variable.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Non-reproducible results due to stochastic randomness and player variabilities. Altitude is not played, which degrades air defense fidelity. Player span of control limits practical number of entities per side to approximately 100. Player decision variability does not permit replication of a specific game. Small unit combat, to include SOF-type activities, is not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Enhanced logistics effects and improved ability to divert air missions to immediate targets.

INPUT: Units: weapon counts, ground speed, supply consumption rates, indirect fire damage capability and range, unit size, and designation. Scenario: terrain description. Attrition: individual weapons data, terrain effects on weapon densities, probabilities of detection and kill for each weapon target pairing, expected aircraft specific exchange ratios, and air defense effectiveness. Game: initial map position and arrival time for each unit played.

OUTPUT: Current status (strength, position, and activity) and map picture of playing screen as desired during game. Strengths over time of weapons by location, activity, type, etc., as desired by analyst in tables and charts.

HARDWARE AND SOFTWARE:

Computer: VAX 780 with VMS.
Storage: 100 words.
Peripherals: Five DEC VT102 terminals, three Ramtek RGB monitors with driver, one printer.
Language: FORTRAN.
Documentation: Under development.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Data Base: One to three weeks (given information availability).

CPU time per Cycle: Approximately 20 mins of each gaming hour.

Data Output Analysis: Postprocessor/analytical aids, hard copy, order streams.

Frequency of Use: Six to eight different war game scenarios per year.

Users: USACAA operates war game for DA Staff, Army agencies and major commands.

Comments: USACAA performs configuration control, model improvements, and maintenance.

DATE IMPLEMENTED: 01/01/82

TITLE: Corps Ammunition Model Expanded (CAM-X)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command, Ft Lee (TRAC-LEE), VA

POINT OF CONTACT: Bruce E. Lasswell, AV 687-1050, Ft Lee, VA 23801

PURPOSE: To furnish information on how supply requests may be satisfied under constraints of load/unload capability, transportation network, and enemy attack.

DESCRIPTION: CAM-X is a physical distribution model created using the MAWLOGS Modeling System. It can be run either stochastically or deterministically. The size and complexity of the system and transportion network to be modeled are determined by the analyst. Requirements for ammunition are input to the model based on other model outputs or by scenarios. Generic convoys move over the network to customers. Supply points and halted vehicles may be attacked. All phases of transportation are considered.

CONSTRUCTION:
Human Participation: Not required--scheduled changes.
Time Processing: Dynamic, event-step.
Treatment of Randomness: Either stochastic, Monte Carlo or basically deterministic as required by the user.
Sidedness: One-sided.

LIMITATIONS: Model requires extensive data input and is not directly related to combat models.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Transportation network, ammunition demands (from other model outputs or SCORES scenario), destruction probabilities, rebuild times, and unit locations and movement.

OUTPUT: Ammunition delivered, ammunition destroyed, transportation mode utilization and schedules.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX 11/780.

STORAGE: Variable.

PERIPHERALS: Printer and tape drive.

PROGRAMMING LANGUAGE: FORTRAN 77.

DOCUMENTATION: A Users Guide for LOGATAK, A Simulation Model to Analyze Logistic Network Distributions and Interdiction. 1977, (DLSIE LD 42543-MB).

OTHER COMMENTS: CAM-X was created using the Models of the Army Worldwide Logistics System (MAWLOGS).

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: N/A.

CPU TIME PER CYCLE: Varies.

DATA OUTPUT ANALYSIS: Two weeks.

FREQUENCY OF USE: Cyclical.

USERS: U.S. Army Ordnance Missile and Munitions School.

COMMENTS: Government agencies can obtain CAM-X with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of CAM-X can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and the supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or calling AV 552-5511 or commercial 913-684-5511.

DATE IMPLEMENTED: 05/01/90

TITLE: Corps Battle Analyzer (CORBAN)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command (TRAC), Operations Analysis Center (OAC) Fort Leavenworth, Kansas 66027-5200

POINT OF CONTACT: Mrs. Horner, ATRC-FM, AV: 552-4595, TRAC-OAC Fort Leavenworth, KS 66027-5200

PURPOSE: Scenario development, operational concepts , seminar trainer

DESCRIPTION: CORBAN simulates battle at the operational level between a Blue Corps and a Red Army. While the primary focus is on the ground battle, the model also plays close air support, battlefield air interdiction, helicopter operations, artillery, and air defense. The model is an aggregated representation of each functional area.

CONSTRUCTION: The model is closed, once loaded, it requires no human participation to run. It is a dynamic architecture which is time stepped. It can be run in either a deterministic or stochastic form. The model plays forces on two sides.

LIMITATIONS: Aggregated output data

PLANNED IMPROVEMENTS AND MODIFICATIONS: None

INPUT:
- Force structure
- Systems data
- Terrain
- Operational orders (templates)

OUTPUT:
- Command and control trace
- FEBA plot
- Variety of assessment data

HARDWARE AND SOFTWARE:

COMPUTER (OS): VMS

STORAGE: 50K

PERIPHERALS: Plotter

PROGRAMMING LANGUAGE: FORTRAN

DOCUMENTATION: Deep Atk Prog Off Final Rpt, 30 Jun 85; Tech Overview, Mar 87; CORBAN Vol I - Users Manual, Apr 86; CORBAN Vol II-Data Struc, Apr 86 CORBAN Vol III - Software Arch, Apr 86; CORBAN Vol IV-Ops Guide, Apr 86

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 2 Weeks

CPU TIME PER CYCLE: 6 Hours CPU/60 Hours simulated battle

FREQUENCY OF USE: Monthly at TRAC

USERS: Studies, Study Agencies, and Study applications for which model has been used: Deep Fires, and O/O study, DA; Deep Atk Prog Off DAPO

COMMENTS: Government agencies can obtain CORBAN with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of VIC can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addresses to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or calling at AV 552-5511 or commercial 913-684-5511.

TITLE: Corps Battle Simulation - CBS (version 1.3)

DATE IMPLEMENTED: 1990.

MODEL TYPE: Training and Education.

PROPONENT: Department of the Army, Project Manager for Training Devices (PM TRADE), 12350 Research Parkway, Orlando, FL 32826-3276.

POINT OF CONTACT: Mr. P. Spangler, DSN 960-4309/(407) 380-4309.

PURPOSE: CBS is used primarily to train Corps and Division Commanders and their staff in the conduct of deep operations/air land battle operations. Also utilized by the Joint Warfare Center for Joint Training.

DESCRIPTION:
Domain: Land and air; Naval operations are not modeled.

Span: Accommodates any geographic area (with the exception of Polar regions) depending on availability of terrain data base. Several terrain data bases completed (Central Europe, Southwest Asia, Central America, Korean Peninsula); others are in preparation.

Environment: Hex based, with a resolution of 3 km wide hexes. Models natural and manmade barriers (roads, rivers, bridges, terrain vegetation, mine fields, contamination, etc.).

Force Composition: Army Corps/divisions; used also for Joint and combined forces, Red and Blue.

Scope of Conflict: Conventional, nuclear, and chemical warfare. Models mid and high intensity conflict.

Mission Area: Conventional, nuclear, and chemical missions.

Level of Detail of Processes and Entities: System supports Corps/divisions with lowest level normally modeled being battalions. With split merge capability, modeling can go down to the individual personnel level if necessary (i.e., MP, scout). Movement or attack/defend/withdraw/delay directives can be issued to ground units. Ground attrition results are based on Lanchester Equations, modified by a rule based A/I system, and results are provided by individual attrition reports and display or unit strength percentages. Can issue directives to individual aircraft. Aircraft attrition based on probability of kill, with groups of aircraft typically modeled as an entity. However, single aircraft can be modeled if necessary. All seven battlefield operating systems (BOS) are modeled (maneuver, fire support, air defense, command and control, intelligence, mobility and survivability, and combat service support).

CONSTRUCTION:
Human Participation: Required for decisions and processes.

Time Processing: Dynamic, event stepped model. Progresses through events at a user specified ratio of exercise time to real time.

Treatment of Randomness: Attrition determined based on Lanchester Coefficients. The attrition results are further refined utilizing a rule based AI system.

Sidedness: Two sided, asymmetric, model with both sides reactive.

LIMITATIONS: Does not model Naval operations, tactics, or warfare. Does not model biological warfare. Does not model low intensity conflict.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Expansion of model capabilities (size, units portrayed) and linkage to other models are under consideration. Additionally, some functionality improvements are also being considered (i.e. Special Operations Forces play), providing enhanced joint forces participation and greatly increasing current capabilities.

INPUT: Requires extensive data base containing information about weapons types and capabilities, unit types and initial locations. Graphics display system requires laser disk containing terrain/geographic data. Operator input is via computer terminals and mouse/digit-pad located at each workstation.

OUTPUT: Graphics display of terrain and unit data. Reports generated as screen display at computer terminals and as hard copy printout.

HARDWARE AND SOFTWARE:
Computer: Designed to run on a DEC mainframe (8600, 8650, 6420) and a network of distributed MicroVAX's (MVII, MV3100).
Storage: Magnetic tape and disk storage media capability as follows:
Mainframe: 1.2 Gb on disk, 950 Mb tape, 128 Mb memory.
Each MicroVAX: 540 Mb on disk, 95 Mb on tape, 16 Mb memory.
Peripherals: Typically 42 workstations per installation site, with each workstation containing: 3 VT320 terminals, 1 laser disk player, 26 inch color monitor, a graphics display controller, a mouse or digit-pad, and one printer.

Programming Language: SIMSCRIPT II.5, "C".

Documentation: Extensively documented with 16 published manuals.

SECURITY CLASSIFICATION: UNCLASSIFIED, but data bases are often classified.

GENERAL DATA:

Data Base: Population of large data bases can take many man-months for initial generation.

CPU Time per Cycle: Model is event stepped and not time stepped. As such, the cycle time is dependent on the data base size, the player configuration, and the current activity. Large exercises can take hours of CPU time to process hours of combat.

Data Output Analysis: There is no post processor analysis of outputs. Output reports are generated during the exercise, and analysis is done manually for after action review purposes. Automated AAR is under consideration.

Frequency of Use: Varies significantly by command, but is used approximately 2-20 times per year, per user installation site.

Users: I Corps, III Corps, V Corps, VII Corps, XVIII Airborne Corps, Battle Command Training Program (BCTP), and Division sites associated with each Corps site. Also utilized by Joint Warfare Center.

Comments: Managed through a configuration control board (CCB) made up of representatives of the user's and the sponsor. Model is continually upgraded based on user needs, and based on priorities established by the CCB. PM TRADE is configuration Manager.

Releasability: Executable code is available for release if coordinated through the CCB. However, source code cannot be released due to configuration management policy.

TITLE: CORPS Support Artillery Model - COSAM

DATE IMPLEMENTED: 30 September 1983.

MODEL TYPE: Analysis.

PROPONENT: Systems Analysis and Evaluation Office, U.S. Army Missile Command, Redstone Arsenal, AL 35898-5060.

POINT OF CONTACT: Nixon W. Powell, DSN 746-3555/(205) 876-3555.

PURPOSE: The COSAM model is a deterministic computer simulation of conventional combat at the corps level. The primary purpose of the COSAM model was to provide the U.S. Army Missile Command (MICOM) with a tool that could be used to analyze the effects of a Corps Support Weapon System (CSWS). The model may be used for the analysis of: tactics, doctrine, operational concepts, force structure, force design using existing types of systems, potential new types of systems, mobilization and reinforcement schedules, and analysis of new design alternatives. Also included as a purpose is the analysis of some stockpile and logistic issues.

DESCRIPTION:

Domain: Land and air.

Span: Corps, battalion and maneuver unit companies.

Environment: Electronic battlefield, traffic ability and weather information.

Force Composition: Mix of land combat systems for both blue and red.

Scope of Conflict: Conventional.

Mission Area: Primarily indirect fire artillery but also includes maneuver units and effects of the air battle.

Level of Detail of Processes and Entities: Number of missions and number of rounds fired. Attrition information for the various fire support means.

CONSTRUCTION:

Human Participation: Does not require human intervention during the simulation of an entire campaign. Human participation is not permitted except for gathering and setting up input data. Also, analysis requires human participation.

Time Processing: Dynamic closed form.

Treatment of Randomness: Deterministic.

GENERATES A VALUE AS A FUNCTION OF AN FXPECTED VALUE

Sidedness: Two-sided, asymmetric and both sides reactive.

LIMITATIONS: Results of rear area target attack is limited to attrition. That is, the effects of delays, disruption, etc., and certain behavioral aspects are not quantified. No explicit capability to play the integrated battlefield.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: The model inputs are categorized as high level and lower level inputs. The high level inputs consist of:

Parameter File: Determine scenario, select run characteristics, select output desired.

Arrivals File: Selectable from the Parameter file.

Binary Data File: No user access.

Lower Level Inputs:

Allowing user to modify selected information in the database (Binary Data File) at run times.

Weather information.

Fire support organizational data.

Fire support candidate performance data.

Fire support mission information.

OUTPUT: The model consists of high level and lower level outputs. The high level outputs consist of:

A concise report will be provided for data of interest concerning rear area loss attritions to various fire support means.

The report will include performance information for fire support means to include the number of missions and number of rounds fired.

No high level outputs will be provided concerning the outcome of the front line combat, e.g., FEBA movement, loss exchange ratios, etc.

Lower Level Outputs:

Lower level outputs are provided by the COSAM Postprocessor.

The outputs vary from loss summary to detailed information on each direct fire engagement.

These outputs are not normally of interest, but should be available to answer detailed questions.

HARDWARE AND SOFTWARE:

Computer (OS): CDC cyber 74.

Operating System: NOS/BE.

Storage: 200K minimum, 60 byte word.

Peripherals: Line printer, magnetic disks and/or tape drives.

Programming Language: FORTRAN IV.

Documentation: Users manuals were published by Vector Research Incorporated. The first manual is dated 31 December 1981 and the last updated manual is dated 30 September 1983.

SECURITY CLASSIFICATION: The program itself is UNCLASSIFIED unless it is labeled. (Labeling here means identifying the weapon systems and rounds used as well as the scenario used).

GENERAL DATA:

Preparation: Time required to gather data is unpredictable. Time to set up data in proper formats might run as much as a week to two weeks, if starting from scratch. If one is only making modifications to an existing set of data, it should require only hours or days rather than weeks.

CPU Time per Cycle: The program itself is completely computerized and run time depends upon the complexity of the problem. Generally CPU time per combat day would be 1-3 minutes.

Data Output Analysis: The time for analysis obviously depends on the number of different variables considered in the analysis. A week or more is usually required.

TITLE: Countermine Combat Model - COUNTERCOM

DATE IMPLEMENTED: 1980.

PROPONENT: U.S. Army Belvoir Research, Development, and Engineering Center, Ft. Belvoir, VA 22060-5606.

POINT OF CONTACT: Keith Dugas, Advanced Systems Concepts Office DSN 354-2095/Comm (703) 664-2095.

PURPOSE: COUNTERCOM was developed to realistically model, at a very high level of resolution (i.e., individual weapon systems), tank/anti-tank combat; air-to-surface and surface-to-air engagements; the effects of indirect artillery and mortar fire (including obscuration and suppression); tactical maneuver and fire plans; the direct and indirect effect of land mines and other obstacles; and countermine/counter-obstacle systems. Besides the applications of mobility/counter-mobility systems within the framework of the modern, integrated battlefield.

DESCRIPTION:

Domain: Land and Air.

Span: Accommodates any region depending on data base; one database scenario completed but outdated.

Environment: Grid-squares. Models transportation barriers. Uses intervisibilities of defender/attacker path pairs.

Force Composition: Combined forces, Blue and Red.

Scope of Conflict: Conventional.

Mission Area: Close air support, indirect artillery.

Level of Detail of Processes and Entities: High resolution; can model individual units, systems. Intelligence and communications modeled. Attrition are based on probabilities, Monte Carlo for individual units.

CONSTRUCTION:

Human Participation: Not required. Human participation not permitted once execution begins.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Stationary defenders, fixed attack paths, has not been updated since 1980.

PLANNED IMPROVEMENTS/MODIFICATIONS: None.

INPUT: Scenario (area of interest, obstacles, terrain intervisibility), defensive types, defensive positions, air defense types, offensive types, sensor reconnaissance routes, tactics tables, probabilities, indirect fire systems, unit paths.

OUTPUT: Ground truth map, input data, battlefield perception map, lane availability map (for minefields), maneuver tactics selected, results file (list of events simulated), graph of survivors vs time, offensive and defensive casualty summaries, m-kills, k-kills, percent survivors by type.

HARDWARE AND SOFTWARE:
Computer: CDC CYBER 6000 series, NOS/VE OS.
Storage: Minimum 75K.
Peripheral: Graphics printer, batch or interactive terminal.
Programming Language: FORTRAN 4 Extended, with some routines in COMPASS 3.
Documentation: Available form DTIC, 2 Vols, ADB061097L.

SECURITY CLASSIFICATION: UNCLASSIFIED, data bases can be classified.

GENERAL DATA:
Data Base: 6 man-months for new data base.

Data Input: 1 man-week to structure input into model.

CPU Time per Cycle: About 10 seconds per cycle.

Data Output Analysis: 1 - 2 days.

Frequency of Use: Infrequent.

Users: BRDEC.

Comments: Has not been updated to include new scenario, weapons data, probabilities in recent times.

Releasability: Only to U.S. Government agencies.

TITLE: DE Combat Simulation - DECSIM

DATE IMPLEMENTED: Oct 1984.

MODEL TYPE: Analysis.

PROPONENT: WS6 Division, RARDE, Fort Halstead, Sevenoaks, Kent.

DEVELOPER: WS6 Division, RARDE, and SD Scicon Ltd.

POINT OF CONTACT: S/WS6 Division, RARDE, 0959 32222 x2381.

PURPOSE: Research and Evaluation tool for the assessment of system and subsystem performance.

DESCRIPTION: Land and low-level air domain; local engagement; digitized terrain; explicit lines-of-sight; two conventional, company-sized, mixed forces of armored fighting vehicles, direct-fire anti-tank guided weapons, anti-tank helicopters and novel weapons; detailed representation of vehicles systems, sub-systems, crew activities, weapon system engagement sequence, target acquisition.

CONSTRUCTION: Non-interactive, non-interruptible; event-stepped; stochastic Monte Carlo; two-sided asymmetric non-reactive.

LIMITATIONS: Number of Units limited to 40 for normal use; combat area limited to 6km by 5km for ground forces, 10km by 8km for helicopters.

INPUT: Digitized terrain data (based on DLMS Level 2); equipment performance data (mobility, weapon characteristics) from MoD R&D Establishments; crew rules.

OUTPUT: Statistically analyzed data on system and sub-system performance.

HARDWARE AND SOFTWARE: VAX 8350 and VAX II/GPX with VMS; 2 Mbyte main memory required for terrain database image; PASCAL; documentation April 1991.

SECURITY CLASSIFICATION: Confidential UK/US Eyes Only (without data).

CPU REQUIREMENTS: 4 hours/rep (40 units, 10 minute engagement, VAX 8350).

FREQUENCY OF USE: Continuous.

USERS: WS6 Division, RARDE.

TITLE: Directed Microwave Energy Weapon Simulation - DMEWS

DATE IMPLEMENTED: September 1987.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity (AMSAA).

POINT OF CONTACT: Director, USAMSAA, ATTN: AMXSY-CS (Mr. Mike Deckert), Aberdeen Proving Ground, MD 21005-5071, Av 298-6675/Comm 301 278-6475.

PURPOSE: A research and evaluation tool used at the component level during system development to estimate the effect of a high power microwave pulse on various electric systems or subsystems. The source and its output characteristics are considered as well as atmospheric propagation, coupling to and location of various entry points on a target, emission losses between the entry point and component, component coupling, and the target path. The primary measure of effectiveness provided by the model is probability of component failure as a function of range and engagement time. DMEWS is a digital, one-on-one engagement model between ground or air targets and a Directed Microwave Energy Weapon (DMEW). The engagement dynamics include probability theory and a version of the AMSAA INCURSION model which has been modified by replacing the air defense gun routine with microwave weapon routines.

DESCRIPTION:

Domain: Land and air.

Span: Individual component.

Environment: Existence of line-of-sight is assumed.

Force Composition: Individual component.

Scoper of Conflict: Any.

Mission Area: Counter to weapons or platforms that contain electrical circuits.

Level of Detail of Processes and Entities:

Entity: System component or subsystem.

Processes: Degrades or kills electrical circuits.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Static, single-pulse model.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: One-sided.

LIMITATIONS: Single pulse probability only; Limited database at higher frequencies.

INPUT: Microwave Generator Characteristics; Antenna Characteristics; Atmospheric/Meteorological conditions; Entry Point Characteristics and Location; Target Component Characteristics; Engagement Parameters.

OUTPUT: Time; Range; Power Density; Accessibility; Access Angles; Probability of damage of each susceptible Component.

HARDWARE AND SOFTWARE:
Computer (OS): IBM PC (DOS).
Storage required: 640K.
Peripherals: None.
Programming Language: FORTRAN 77.
Documentation: Available. DDC Accession Number: None.

SECURITY CLASSIFICATION: (Model without data) UNCLASSIFIED.

GENERAL DATA:
Database: N/A (time required to prepare).

CPU Time per Cycle: 2 seconds.

Data Output Analysis: Analyst dependent.

TITLE: Direct Fire Stand-Alone Model - DFSAM

DATE IMPLEMENTED: 1985.

MODEL TYPE: Analysis.

PROPONENT: CA4 Division, RARDE, Fort Halstead.

POINT OF CONTACT: N. Roberts, RARDE, ext 2289.

PURPOSE: Research and Evaluation of weapon systems effectiveness.

DESCRIPTION:
Domain: Land.

Span: Local (typically up to 20km front).

Environment: Digitized terrain, representing relief, vegetation and man-made cover, 500m resolution.

Scope: Conventional.

Mission Area: Direct fire battle.

Level of Detail: Company (Red) vs Troop (Blue). High-value units (e.g. LRGW) may be represented individually. Lanchester-based attrition. Movement is along preplanned routes, at speed governed by local going.

CONSTRUCTION:
Human Participation: Not required, but is permitted.

Time Processing: Partially time-sliced, partially event sequenced.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: No infantry. No C3I.

PLANNED IMPROVEMENTS: None.

INPUT: Weapon characteristics (range, time of flight); Minefield and barrier data (location, mine density, etc.); Order of Battle, deployment, routes, orders; Systems data (DF SSKP data, minefield lethality, artillery lethality).

OUTPUT: Killer/victim tables, by replication and averaged; Mine and artillery kills.

HARDWARE AND SOFTWARE:
Computer/OS: VAX/VMS.
Storage: 20 Mb (40000 blocks).
Peripherals: Requires DEC VT100, VT200 or VT300 compatible terminal.
Language: FORTRAN 77.
Documentation: User's guide, Programmers's guide.

CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Preparation: Several weeks.
Preprocessor: Few CPU minutes.
Simulation: Approx one minute CPU time per minute of battle.
Analysis Package: Minimal. NB timings are based on a complex main defensive action scenario.

Frequency of Use: Rare.

Users: CA4 Division RARDE.

Comments: DFSAM uses the same DF modelling as the Divisional War Game (DWG) from CA3, RARDE, and was originally intended to be used to replicate small elements of the DWG campaign and DFSAM normally uses systems data files created for DWG use. It is intended that the modelling link between the two models be maintained.

TITLE: Divisional War Game - DWG DATE IMPLEMENTED: 1975.

MODEL TYPE: Analysis.

PROPONENT: CA3 Division, RARDE, Sevenoaks, Kent.

POINT OF CONTACT: Dr. I. P. Gibson, 0959 32222 ext 2451.

PURPOSE: A research and evaluation tool primarily concerned with examining the use of proposed weapon systems but also contributing to the analysis of concepts of operations.

DESCRIPTION:
Domain: Land, with representation of air operations in less detail.

Span: Corps.

Environment: Terrain and cultural features represented to 500m resolution. Meteorological effects vary with time of day.

Force Composition: All arms, but with less attention paid to direct fire systems than to others.

Scope of Conflict: Conventional.

Mission Area: Corps and division level systems.

Level of detail of processes and entities: The lowest entity modelled is generally a troop, but some high value equipments are represented as individual vehicles. Attrition is represented in most detail for indirect fire and AH; movement and engagement are a player's discretion constrained by the rules of the game. Communications between players simulate the net structure of the force.

CONSTRUCTION:
Human Participation: Is required for decisions, without which the game would run but not make sense. Multiple command levels are explicitly represented.

Time and Processing: Dynamic, event step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Numbers of individual units less than 4000 each side. Rate of play typically 10-15 minutes real time to 1 minute combat time.

PLANNED IMPROVEMENTS/MODIFICATIONS: Continually updated to incorporate new systems. Much of the software is being reimplemented.

INPUT: ORBAT, opening deployment, equipment characteristics.

OUTPUT: Controllers' report; data appropriate to study topics. An archive of past series is maintained from which data are provided for a wide range of studies.

HARDWARE AND SOFTWARE:
Computer: Dec 8810, VAX/VMS (dedicated).
Storage: CPU: 128 Mbyte, disk: 3 Gbyte.
Peripherals: 6 Sigmex graphics terminals, 2 micro VAX II, 30-40 VDUs; 20-25 printers, 2 line printers, 2 magnetic tape drives; 10 Macintosh IIci graphics workstations.
Programming Language: VAX FORTRAN, to be reimplemented in C.
Documentation: Functional specification.

SECURITY CLASSIFICATION: Restricted.

GENERAL DATA
Data Base: 20-30 days, including deployment of units using Macintosh graphics workstation.

CPU Time per Cycle: Dependent on phase of battle (i.e. number of units in play and their activities). In practice, cpu time is less critical than the players in determine game speed.

Data Output Analysis: An extensive relational database is created for each game and used to derive statistical and other information on weapon system performance. The database is implemented in RdB (full supporting documentation is available).

Frequency of Use: A series of five games (each lasting one month) is played each year, plus occasional extra activities.

Users: RARDE.

Comments: A replay facility is available for limited replication and parametric variation.

TITLE: Division Level War Game Model - DIVLEV

DATE IMPLEMENTED: 1969.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity.

POINT OF CONTACT: Director, USAMSAA, ATTN: AMXSY-CC, Tony Rouse, Aberdeen Proving Ground, MD 21005-5071, AV 298-5771/301 278-5771.

PURPOSE: A research and evaluation tool used during system development and to estimate system effectiveness.

DESCRIPTION: DIVLEV is both a stand-alone combat simulation and man-in-the-loop war game. The methodology has been calibrated through comparisons with historical battle results. The model was developed to produce realistic tactical situations, accounting for the environment and capabilities of opposing forces, and including unit orders, optional contingency orders, movements and attrition as a function of time. These situations are used in the evaluation of various item level materiel systems and in evaluations of weapon mixes. The resolution of units that the players control is usually determined by the objective of the study and the tactics the players intend to use. Generally, the player-controlled units are of battalion or company size. DIVLEV is structured so that players control the organization for combat. They can use either standard TO&E units or task forces, and these units can be at either full or reduced strength. The players give orders and optional orders to each unit which include the route the unit is to take, the unopposed speed at which it is to move, the dimensions of the unit (whether deployed or in column), and the direction the unit is to face upon reaching its destination. Optional orders are activated when player described conditions are met. Once an optional order is activated, the old order is discarded and the unit starts on its new assignment. DIVLEV contains a representation of suppression by both direct and indirect-fire weapons, a treatment of system reliability, and a representation of close air support. Suppression effects are based on combat experience. Target acquisition is played explicitly. The time step is variable.

Once sets of player-generated contingency orders have been developed, the model can be used as a combat simulation. In this mode, the same player inputs are used, but different weapon characteristics, artillery target priorities, sensor mix, artillery attack criteria, and so forth can be input. This feature allows for the parametric evaluation of weapon and support systems, doctrine, and trade-offs among them in terms of force success.

Domain: Land and air.

Span: Regional.

Environment: Terrain relief, mobility characteristics and cultural features, weather, and time of day.

Force Composition: Combined forces.

Scope of Conflict: Conventional.

Mission Area: Tactical combined arms.

Level of Detail of Processes and Entities:
Entity: Blue Division, Red Army.
Processes: Movement, target acquisition, command and control, attrition, suppression.

CONSTRUCTION:
Human Participation: Optional, for decisions, and if there is human participation the model is designed to be interrupted for the introduction of a new set of decisions.

Time Processing: Dynamic, time step.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided.

LIMITATIONS: Unit logistics are recorded, not individual weapon

PLANNED IMPROVEMENTS/MODIFICATIONS: Effort is underway to improve real-time visual displays and pre- and post-game processing.

INPUT: Tactical scenario--initial situation and unit objectives; Weapon data--range, rate of fire, crew size, weight of ammunition, and range dependent kill rates; Terrain statistics, wooded and urban areas; Unit data to include position, equipment strength and maneuver instructions; Vehicle speeds.

OUTPUT: Plots showing unit position; Unit data to include unit position, strength, and interaction with opposing units; Killer-victim scoreboard; The time interval for any of the output can be specified by input codes.

HARDWARE AND SOFTWARE:
Computer (OS): SUN (UNIX), VAX 11/785 (VMS and UNIX).
Storage required: 150K.
Peripherals: Disc storage, tape, printer, video, work stations.
Programming Language: FORTRAN 77.
Documentation: "DIVLEV War Game Computer Program," USAMSAA, January 1977.

SECURITY CLASSIFICATION: (Model without data) UNCLASSIFIED.

GENERAL DATA:

Database: Four man-months for initial development, Division vs. Army; three man-months for weapon and other system, and terrain data.

CPU Time per Cycle: SUN, simulation mode, two hours per 24 hours of simulated combat; SUN, war game (man-in-the-loop) mode, 15 minutes per one hour game step.

Data Output Analysis: One week per variation from initial game, plus one month after last variation for summaries.

TITLE: ELAN Plus (ELAN+)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command - White Sands (TRAC-WSMR), White Sands, NM 88002-5502

POINT OF CONTACT: Dr. H. M. Sassenfeld, TRAC-WSMR, ATRC-W, WSMR, NM 88002-5502, DSN: 258-1615, Commercial (505) 678-1615.

PURPOSE: Weapon effectiveness analysis, terrain, scenario and tactical analysis training.

DESCRIPTION: ELAN+ is a medium resolution, two-sided, event sequenced, deterministic/stochastic combat model for brigade and battalion level. Combat activities modeled are maneuver, acquisition, direct fire, fire support, smart munitions, mines, smoke, and weather. Actions and reactions can be triggered (specifiably) for maneuver, fire, terrain, and other environment. Interactively driven by menus and graphics. Extensive analysis capability of digital terrain.

LIMITATIONS: Brigade level; no logistics; no explicit communications

PLANNED IMPROVEMENTS AND MODIFICATIONS: Dismounted infantry, Air Defense

INPUT: Routes of forces, forced (specifiable by unit and task force), maneuver and fire support schedules, weapon performance data (from AMSAA data derived values) from video terminal; weapon performance data from tape; Digital terrain.

OUTPUT: In graphics and print: scenario, measures of effectiveness (70Es) hierarchical force diagram.

HARDWARE AND SOFTWARE:

COMPUTER (OS): Hewlett Packard 9000 series; UNIX, HPBasic

STORAGE: 8 MB RAM

PERIPHERALS: Hard disk, printer, color monitor

PROGRAMMING LANGUAGE: HPBasic, PASCAL

DOCUMENTATION: Available

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

COMMENTS: Government agencies can obtain ELAN+ with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of ELAN+ can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or calling AV 552-5511 or commercial 913-684-5511.

TITLE: Error Analysis - ERAN Model DATE IMPLEMENTED: 1988.

MODEL TYPE: Analysis.

PROPONENT: HQCECOM, Attn: AMSEL-PL-SA, Ft Monmouth, NJ 07703-5000

POINT OF CONTACT: Edwin Goldberg, AV 992-3646/(201) 532-1878.

PURPOSE: Research and Evaluation tool to enable an analyst to use the ERAN to perform an error analysis of a line-of-bearing (LOB) target location system using multiple ellipse techniques.

DESCRIPTION:
Domain: Any combination of the identified items.

Span: Local.

Force Composition: Component, element.

Scope of Conflict: Conventional.

Mission Area: Air, land and sea.

CONSTRUCTION:
Human Participation: Required for input data.

Time Processing: Model is static.

Treatment of Randomness: Stochastic; direct computation.

Sidedness: One-sided.

LIMITATIONS: Single target.

PLANNED IMPROVEMENTS/MODIFICATIONS: None.

INPUT: Angle measurement error of sensor and other data identified in the 31 May 88 user's guide and program documentation.

OUTPUT: Statistically analyzed data and other analysis (see 31 May 88 user's guide and program documentation).

HARDWARE AND SOFTWARE:
Computer: Any.
Storage: Minimal storage required.
Peripherals: Printer.
Programming Language: FORTRAN.

Documentation: The ERAN model documentation includes a user's guide and program documentation manual which is located at the CECOM Program Analysis and Evaluation Directorate, Fort Monmouth, NJ.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:

Data Base: N/A.

CPU Time per Cycle: Negligible.

Data Output Analysis: Computer output is self instructive and complete.

Frequency of Use: Currently in use.

Users: CECOM Center for Electronic Warfare/Reconnaissance Surveillance and Target Acquisition, Fort Monmouth, NJ.

Releasability: Releasable to Govt only.

TITLE: Evaluation of Air Defense Effectiveness - EVADE II

DATE IMPLEMENTED: June 1969.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: Wyoming Paris/Everett White, AV 298-6382/84.

PURPOSE: The EVADE model is used to evaluate the survivability and effectiveness of aircraft and aircraft systems, and the effectiveness of air defense weapons, countermeasures, tactics and techniques. It is a deterministic model that evaluates fixed and rotary-wing aircraft in-scenario, in combat with an array of ground air defense gun and missile systems utilizing digitized terrain. Aircraft fly predetermined paths over prepositioned weapons systems. EVADE II is a research and evaluation tool that permits study of air vehicle interactions with air defense gun and missile systems.

DESCRIPTION:

Domain: Ground-to-air and air-to-ground.

Span: Regional, limited, or local arena.

Environment: Digitized terrain (cities, forest, orchards, high grass, bare earth), signatures function of weather and lighting, ECM.

Force Composition: Multiple aircraft and multiple ground weapon systems.

Scope of Conflict: Conventional Red and Blue weapons systems.

Mission Area: Anti-armor, close air support, airlift, direct fire weapons.

Level of Detail of Processes and Entities: Calculates the probability of Attrition Kill, Forced Landing, and Mission Abort as well as aircraft and troop losses for air participants; mobility, firepower, and combined mobility-fire power damage levels for ground targets.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic with time steps.

Treatment of Randomness: Expected value deterministic.

Sidedness: Two-sided symmetric.

LIMITATIONS: Fixed flight paths for a given run, maximum of 32 aircraft independent paths (with-out changing dimensions), maximum 1000 ground weapon systems, no continuous movement of ground systems (multiple "snapshots" are used).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Incorporated of Air Defense Network (ADNET), Command, Control Communication, Intelligence, Prioritization (C3IP) Links, FM2 Grid (read-in optimization) in Terrain Database.

INPUT: Interactive input routine, Ground weapon characteristics and location, aircraft characteristics (flight path, weapon systems, vulnerable areas, speed, etc.), digitized terrain (with vegetation) DMAHTC, radar detection, countermeasures (warning receivers, jammers), SAM Pk's, aircraft signatures.

OUTPUT: Time history of engagement (firings and subsequent kill damage, etc), assessment of air and ground losses, number of rounds and missiles fired, dynamic graphics mission portrayal.

HARDWARE AND SOFTWARE:
Computer: Alliant, CRAY XMP, CRAY II, Interactive EVADE Input Routine, Dynamic Graphics Output Routine.
Storage: Program: Approx. 677 kilobytes.
Peripherals: Graphics terminal, PC for interactive version.
Program Language: FORTRAN.
Documentation: Users manuals available.

SECURITY CLASSIFICATION: UNCLASSIFIED. Interactive run setup program being developed. Model and database are SECRET.

GENERAL DATA:
Data Base: Dependent on available input data - 1 day to 2 weeks.

CPU Time per Cycle: Dependent on data base size and player configuration. Large exercises can take 5 hrs of CPU time.

Data Output Analysis: 5 mins to 5 hrs depending on level of analysis and desired complexity of scenario.

Users: Past users include AVRADCOM, St. Louis, MO; AMSAA, Aberdeen Proving Ground, MD; Ketron Inc., Towson, MD; MAD, Crane, IN; CIA. Currently AMSAA and Ketron are active users.

TITLE: Extended Directed Energy Combat Simulation - EDECSIM

DATE IMPLEMENTED: 1989.

MODEL TYPE: Analysis.

PROPONENT: CA4 Division, RARDE Fort Halstead, Sevenoaks, England.

POINT OF CONTACT: Mr. D. F. Wardleworth, 0959 32222 ext 3388.

PURPOSE: Study of effectiveness of conventional and novel DF weapons and smart munitions.

GENERAL DESCRIPTION:

Domain: Land; representation of rotary wing aircraft and low level air defence under development.

Span: There is no hard upper limit terrain size nor on numbers of units represented. Several hundred units on an area 20km square have been studied.

Development: Terrain height and vegetation/building cover are modelled to a horizontal resolution of 100m. Obscuration, poor visibility and TI sensors can be represented but pyrotechnic illumination and other night viewing enhancements are not currently modelled.

Force Composition: EDECSIM is 2-sided and represents the essential characteristics of vehicle borne and certain dismounted weapons. Infantry and fixed wing aircraft are not represented.

Scope of Conflict: Conventional weapons; other systems may be accommodated by program modification if suitable data is available.

Mission: Normal study parameters include attrition; assessment of assault success and enemy observation are also possible.

Level of Detail: Individual vehicles are represented and a variety of surveillance and engagement tactics can be selected. Vehicle routes are pre-specified although a limited number of responses to battle development are possible. Smart munition missions are controlled by an autonomous module which deduces viable targets from observer reports; this module includes limited representation of communications. Obscuration, conventional artillery and minefields are represented implicitly.

CONSTRUCTION:

Human Participation: None, but scenarios are based on man-in-the-loop wargames.

Time Processing: Event-sequenced.

Treatment of Randomness: Stochastic.

Sidedness: Two-sided, sides are interchangeable with no limits on size apart from overall constraints.

TITLE: Fire Support Command and Control Analysis Tool - FISCCAT

DATE IMPLEMENTED: 1987.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity.

POINT OF CONTACT: Director, USAMSAA, ATTN: AMXSY-CC (Mr. Peter Norman), Aberdeen Proving Ground, MD 21005-5071, AV 298-6541/Comm 301-278-6541.

PURPOSE: A research and evaluation tool for use during system development and to estimate system effectiveness. The FISCCAT model was designed to aid in the evaluation of the item level performance of the Advanced Field Artillery Tactical Data System (AFATDS). It focuses on the message processing required within the fire execution mission.

DESCRIPTION: FISCCAT is a one-sided, discrete events simulation. The stimulus for the model is a list of targets of opportunity. FISCCAT was designed with flexibility in mind -- both force structure and network characteristics can be easily changed to examine different configurations of artillery command and control.

Domain: Land.

Span: Regional (any region).

Environment: Not applicable.

Force Composition: Artillery command and control within a maneuver brigade supported by a Direct Support Battalion.

Scope of Conflict: Any level that includes artillery command and control.

Mission Area: Indirect artillery command and control and sensors.

Level of Detail of Processes and Entities:

Entity: Artillery command and control within a maneuver brigade supported by a Director Support battalion.

Processes: Targets introduced into the simulation trigger message traffic by the node that "acquires" the target. Subsequent message traffic results as the target is processed. While the model accounts for representative time for batteries to fire missions, the model does not include the results of weapon fire and so provides measures of performance rather than effectiveness.

CONSTRUCTION:
Human Participation: Not permitted.

Time Processing: Dynamic, event step.

Treatment of Randomness: Stochastic or deterministic, depending on data availability and study purpose.

Sidedness: One-sided.

LIMITATIONS: Assumes Perfect Communications; Nodes 100% Available; Mission Characteristics Not Dynamic (i e., they are input); Represents Only Brigade Slice of Fire Support Assets; Unlimited Amount of Ammunition Played.

PLANNED IMPROVEMENTS/MODIFICATIONS: Add division assets, and more sensors.

INPUT: Force Structure; Communications Net Structure; Processing Times (Device and Operator); Fire Request File.

OUTPUT: Fire Mission Data (detailed data on fire missions requested, those completed, and those rejected); Fire Unit Data (hourly summary of fire unit usage); Net Utilization Data.

HARDWARE AND SOFTWARE:
Computer (OS): SUN (UNIX), Gould (UNIX), 11/785 (VMS).
Storage Required: 10 Megabytes of Hard Disk.
Peripherals: None.
Programming Language: SIMSCRIPT.
Documentation: Draft input manual.

SECURITY CLASSIFICATION: (Model without data) UNCLASSIFIED.

GENERAL DATA:
Database: Eight man-weeks to develop new force structure input.

CPU Time per Cycle: 10 to 60 minutes for 20 hours battle with 20 to 180 targets per hour.

Data Output Analysis: Several weeks depending on study complexity.

DATE IMPLEMENTED: 11/10/89

TITLE: First Battle: Battalion through Corps (FB: B-C)

MODEL TYPE: Training and Education

PROPONENT: U.S. Army Combined Arms Command - Training, ATTN: ATZL-CTS
Ft. Leavenworth, KS 66027

POINT OF CONTACT: CPT John Hughes, ATZL-CTS-BB, AV 552-3189
USACAC-Training, Ft. Leavenworth, KS 66027

PURPOSE: FB: B-C trains unit commanders and staffs in the control and coordination of combined arms operations in a simulated combat environment. Exercises a unit's tactical SOP's.

DESCRIPTION:
Domain: The model plays land, air and sea.
Span: Any map - theater to local.
Environment: Played on standard maps. Plays day/night. Models road bridges, cities and obstacles.
Force Composition: Any force.
Scope of Conflict: Plays all weapon systems including NUC/CHEM.
Mission Area: Conventional force to corps.
Level of Detail of Processes and Entities: Army to single soldier.

CONSTRUCTION:
Human Participation: Human participation required for decisions and to process model.
Time Processing: Static.
Treatment of Randomness: Stochastic, Monte Carlo.
Sidedness: Two-sided, asymmetrical.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Update user and training documentaion.

INPUT: Movement/critical orders, unit names/locations, resupply, scenario.

OUTPUT: Conflict resolution, Battle Damages, personnel and logistics, loses and reports.

HARDWARE AND SOFTWARE:

COMPUTER (OS): IBM compatible PC. MS DOS

STORAGE: 10 megabyte hard disk with a minimum of 5 megabytes free.

PERIPHERALS: Epson-type printer.

PROGRAMMING LANGUAGE: Turbo Pascal

DOCUMENTATION: Installation guide, Basic Rules and Supplements for play.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 1 day.

CPU TIME PER CYCLE: Unknown

DATA OUTPUT ANALYSIS: N/A

USERS: Commanders and staffs, battalion through corps.

TITLE: Flexible Attrition Model - FAM

DATE IMPLEMENTED: 1988.

MODEL TYPE: Analysis.

PROPONENT: Directorate Science (Air), Ministry of Defence, Main Building, Whitehall, London SW1A 2HB.

DEVELOPER: Software Sciences Limited, Meudon Avenue, Farnborough, Hampshire, GU14 7NB.

POINT OF CONTACT: Assistant Director Sc2 (Air). Military - 87068MB, Civilian - 071-21-87068.

PURPOSE: Mission level research, evaluation and operational support tool, simulating the land/air battle, specifically the interaction between airborne defensive systems and ground based Air Defence systems; with applications for both airborne and ground based weapon system effectiveness, force requirement and mix, deployment, concept evaluation and decision making evaluation.

DESCRIPTION:

Domain: Land/air.

Span: Global, accommodates any theatre for which a ground data base exists.

Environment: Models terrain and cultural features.

Force Composition: Blue on Red/Red on Blue.

Scope of Conflict: Conventional or Nuclear environment; Airborne defensive systems - ECM, RWR, IR flares, Chaff, anti-radiation missile; Ground-based Air Defence systems - Surveillance, acquisition and tracking sensors and associated weapon systems, SAM, gun, laser.

Mission Area: All airborne missions including stand-off activity and penetration by manned aircraft, UAV or missile.

Level of Detail of Processing and Entities:

Processes: Attrition/survivability of airborne platforms, effects of C3I of Ground Based Air Defence systems, defence suppression, effects of stealth on platform survivability.

Entities: 64 air vehicles against 100 ground sites, large aircraft formations down to single defensive system on singleton aircraft, multiple networked ground sites down to single autonomous site. Attrition/survivability for aircraft are, probability of kill, Monte Carlo based, stochastic, output for ac/system by type, group or formation.

CONSTRUCTION:
Human Participation: Not required. Not permitted after the initial set-up (Scenario Generation) phase.

Time Processing: Dynamic, event based model, with some activities time-stepped.

Treatment of Randomness: Air attrition stochastically based on computation of probability of detection, engagement and probability of kill, with Monte Carlo determination of results.

Sidedness: Two-sided with symmetric modelling of the activity within both air and ground environments.

LIMITATIONS: Does not model air-to-air engagements.

PLANNED IMPROVEMENTS/MODIFICATIONS: Model is constantly being developed under Ministry of Defence contract. Current development includes improvement to aircraft reactive manoeuvre, C3I, EW and missile guidance modules.

INPUT: Graphical scenario definition package.

OUTPUT: Graphics analysis package.

HARDWARE AND SOFTWARE:
Computer: Designed to run on PRIME computer, VAX computer and SUN workstation, but model is fully transportable.
Storage: 22 megabytes (for executable version).
Peripherals: Minimum requirements: Sun sparcstation I.
Programming Language: FORTRAN 77.
Documentation: Extensively documented at four levels from high level functional overview down to code.

SECURITY CLASSIFICATION: UNCLASSIFIED, but individual modules are classified up to SECRET.

GENERAL DATA:
Data Base: Example modules are available.

CPU Time per Cycle: Small scenarios completed in several minutes.

Data Output Analysis: Results available in both hard copy and graphical format.

Frequency of Use: Continuous studies and development.

Users: Currently in use with Directorate of Science (Air) Ministry of Defence; Atomic Weapons Establishment; Operational Research Branch Headquarters Royal Air For Strike Command; Systems Assessment Department, Royal Aerospace Establishment Farnborough; Defence Operational Analysis Organization (Germany).

Comments: Currently investigating methods of inputing EW data from Electronic Warfare Combat Evaluation System (ECMES) computer simulation evaluation tool in use with MOD. Configuration control management exercised through the FAM Users and Development Group (MOD).

TITLE: Force Analysis Simulation of Theater Administrative and Logistics Support - FASTALS Model

DATE IMPLEMENTED: 1971.

MODEL TYPE: Analytical.

PROPONENT: U.S. Army Concepts Analysis Agency, Attn: Force Directorate, 8120 Woodmont Avenue, Bet :sda, MD 20814-2797.

POINT OF CONTACT: Mr. Raymond G. McDowall, (AV) 295-1658.

PURPOSE: The objective of FASTALS is to develop the balanced, time-phased support force requirements for a specified combat force. FASTALS is used primarily for force planning studies and analysis generally in the context of the Defense Guidance Illustrative Planning Scenario (DGIPS).

DESCRIPTION:

Domain: Land.

Span: Each run accommodates one theater with a specified combat force in a combat scenario.

Environment: Theater dependent.

Force Composition: Specified by study sponsor and used to generate requirements for Army logistical units.

Scope of Conflict: N/A.

Mission Area: FASTALS is a deterministic computer program that was developed to generate the time-phased Army support requirements that result from a given combat simulation.

Level of Detail of Processes and Entities: Support requirements are generated for each unit type (functional area) including engineer, chemical, medical, transportation, ordnance, quartermaster, et al, by Standard Requirements Code (SRC). The workload requirements needed to sustain the forces are also generated and displayed workloads include maintenance, construction, supply consumption, transportation, patient care, personnel replacement, and other.

CONSTRUCTION:

Human Participation: All inputs are developed by functional area analysts prior to model execution. No interaction is permitted during model execution.

Time Processing: Dynamic time-step.

Treatment of Randomness: Determination.

Sidedness: One-sided.

LIMITATIONS: No attrition to support units or retrograde movement operations; single movement of units and supplies from point of arrival to destination.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Continue to develop routines to facilitate and enhance data entry and retrieval.

INPUT: The following data base in magnetic tape form and used. Military Traffic Management Command weights file, Army MARC Maintenance Data Base, Force Accounting System unit data, and Consumption factor data (provided on floppy disks) from the U.S. Army Logistics Center.

OUTPUT: Force listing is in the form of a time-phased troop list indicating unit requirements by SRC.

HARDWARE AND SOFTWARE:
Computer: UNISYS 1100/84.
Storage: 1.5 Mb.
Peripherals: Two 9-tract, 6250-byte-per-inch tape drives.
Language: FORTRAN-77.
Documentation: User's Manual and Programmer's Guide.

GENERAL DATA:
Data Base: One man-month or more depending on size of force and complexity of theater being evaluated.

CPU Time Per Cycle: Thirty minutes.

Data Output Analysis: Two weeks or more depending upon theater.

Frequency of Use: Used approximately 30 times per year for record runs.

Users: USACAA, U.S. Army Logistics Center, U.S. Army Logistics Evaluation Agency.

Comments: This mode has been used for 20 years to develop the support force requirements for the Army and is accepted as the standard by which other models are measured.

TITLE: Force Evaluation Model - FORCEM

DATE IMPLEMENTED: 1985.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Dr. R. Johnson, (AV) 295-1593/(301) 295-1593.

PURPOSE: The model provides simulation of airland activities in a theater of operations over an extended period (up to 90 days). Combat operations are at the division level and most of the combat support and combat service support functions from the port to FLOT are represented. It is a fully computerized simulation for application in studies and analyses of force planning and resource allocation issues. The model is part of a three level hierarchy of Army simulation models (at Battalion, Division/Corps and Theater) developed under the Army Model Improvement Program.

DESCRIPTION:

Domain: Land - air.

Span: Theater campaign. Current data bases are Central Europe, and Southwest Asia.

Environment: Terrain square of selectable size (5-30km). Eight terrain types, including urban and water areas, affecting movement. Day and night difference for some operations. No weather. Road, rail and water transport represented as networks.

Force Composition: Joint and combined forces. Blue and Red. Blue force partitioned into two components for resource accounting purposes.

Scope of Conflict: Primarily conventional. Chemical module operational and nuclear module under development.

Mission Area: Theater ground operations with fire support (including air) and combat service support, including medical, maintenance, supply, and transportation functions.

Level of Detail of Processes and Entities: The level of resolution of combat units is the division. Combat support and combat service support operations are represented by smaller organizational elements, or as aggregates of smaller units (e.g. a single support command at each echelon representing all combat service support activities). Functional submodels represent the major activities of target acquisition, communications, command and control, division engagement, fire support, air operations, unit movement and combat service support. As an average value simulation, without player interaction, command and control is represented by automated decision processes at three levels in the theater (Corps, Army Group, Theater). Assessment of division battle is made through an analytic representation of a division engagement with sets of attrition coefficients calibrated to the results of engagements simulated by an independent division model. Air operations are represented by groups of aircraft, by mission (eight possible), in an air sector (roughly Corp or Army) or, in a few cases, theater-wide. Area air defense is considered at the same air sector level.

CONSTRUCTION:

Human Participation: Model is interruptable, mostly for purposes of command and control to change unit boundaries and phase lines or air role apportionment factors. Scheduled changes also allowed.

Time Processing: Dynamic, time step model with twelve hour time cycle.

Treatment of Randomness: Deterministic, without randomness in the model. Some inputs are expected values generated from stochastic processes.

Sidedness: Two sided, generally symmetric. Command and control input data may be varied by national component on each side to represent different decision factors.

LIMITATIONS: No naval operations, weather, engineer functions, EW or rear area combat. Highly aggregated intelligence and communications.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Presently revising command and control and engagement process for asymmetric representation of Blue and Red operations and for better representation of breakthrough and reserve and second echelon force employment. Upgrades to intelligence/target acquisition and nuclear/chemical representation and addition of engineer functions planned.

INPUT:

- In-theater force-units and their assets
- Arrival schedule-units and assets
- Theater scenario and plans
- Terrain
- Engagement results from division level simulation
- Weapons and equipment characteristics
- C^2 decision criteria
- Performance factors for surveillance, communications, repair, medical, transport, etc., functions

OUTPUT:

- Computer reports, giving status, losses, and expenditures of units and assets over time
- Computer graphics graphs and map displays
- Hard copy plots and charts

HARDWARE AND SOFTWARE:

Computer: UNISYS 1100/84, SUN 4/260.

Storage: One to three million decimal words, depending on scenario.

Peripherals: Disk storage, demand CRT terminal, computer graphics terminal and plotter for input and output preparation, tape unit for checkpoint/restart capability.

Programming Language: SIMSCRIPT II.5.

Documentation: FORCEM Input Data, October 1990; FORCEM Output Reports, May 1989. Formal documentation not yet published.

SECURITY CLASSIFICATION: UNCLASSIFIED, without data.

GENERAL DATA:

Data Base: Three to six months required to build new data base from scratch.

CPU Time Per Cycle: Depends on scenario. Average of 15-20 minutes per twelve hour cycle.

Data Output Analysis: Highly variable, depending on study. Large volume of output is reduced, combined and manipulated by a post processor information retrieval system (UNISYS MAPPER).

Frequency of Use: Four per year for major studies.

Users: Used only at the U.S. Army Concepts Analysis Agency.

Comments: Model operates in hierarchial mode and is dependent on results from higher resolution division model (presently COSAGE) for combat attrition and munition expenditures.

TITLE: General Full Spray Materiel/Personnel Mean Area of Effectiveness - MAE (AKA Lethal Area Program)

DATE IMPLEMENTED: 1979 (JTCGME Version).

MODEL TYPE: Analysis.

PROPONENT: U. S. Army materiel Systems Analysis Activity, Ground Warfare Division, Support Warfare Analysis Branch, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: Russell Dibelka, DSN 298-5046/(301) 278-5046.

PURPOSE: The Lethal Area Program is used to analyze item level performance by computing the effectiveness of one conventional weapon against one materiel or personnel target.

DESCRIPTION:

Domain: Surface-to-surface, air-to-surface.

Span: Individual (Item).

Environment: Open environment is the default condition. The environmental shielding of the target option allows a choice of tropical forest, temperate forest, jungle tangle, and coniferous forest. Another option allows the effect of tall grasses on projectile drag to be evaluated. Personnel targets are assessed in four postures: standing, prone protected, and crouching in a foxhole.

Force Composition: One-on-one, Red and Blue.

Scope of Conflict: Indirect fire weapons such as unitary warheads, submunitions, flechettes, mortars, bombs, laser-guided munitions, and terminally-guided munitions.

Mission Area: Fire Support and Close Combat Light (mortars only).

Level of Detail of Processing and Entities: The only entity modelled is an individual weapon versus an individual target. No processes such as attrition, communications, and movement are modelled.

CONSTRUCTION:

Human Participation: None required not permitted.

Time Processing: Static.

Treatment of Randomness: Stochastic model with direct computation.

Sidedness: One-sided.

LIMITATIONS: The effects of blast on the target and a direct hit on the target cannot be modelled simultaneously. Multiple critical components (i.e., site kills) cannot be modelled. Lethal area is calculated for only one submunition (bomblet), not the entire payload.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Link input and output dir directly to Fire Support database.

INPUT: Weapon characteristics and fragmentation data, target vulnerability data.

OUTPUT: Computer printouts containing input data and lethal areas. Options permit calculation and printouts of other measures of effectiveness (PKs, CEP's, etc).

HARDWARE AND SOFTWARE:
Computer (OS): Alliant computer UNIX-type operating system (AMSAA Version); Cyber Computer with NOS operating system (JTCG/ME version).
Storage: .36 megabyte (FORTRAN code only).
Peripherals: Printer.
Programming Language: FORTRAN V.
Documentation: Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME manuals).

SECURITY CLASSIFICATION: Model is UNCLASSIFIED, however, input and output are usually classified up to SECRET/NOFORN.

GENERAL DATA:
Data Base: New fragmentation data (primarily from arena testing) can take several man-months after testing is completed to be made available. New target vulnerability data (primarily developed by the Ballistic Research Laboratory) can take one man-year. To set up an input file for one weapon/target combination with existing fragmentation and vulnerability data from the Fire Support database takes a few minutes.

CPU Time Per Cycle: Usually less than five minutes and frequently less than one minute.

Data Output Analysis: Input data are printed for verification purposes. Lethal area output is used as input to the ARTQUIK model as well as several higher models. However, there is no direct linkage between the models nor specific analysis of the lethal area output.

Frequency of Use: Varies with the number of studies being supported, but probably several hundred times throughout the year.

Users: AMSAA, OSU-Field Office (JTCG/ME version), DoD contractors, other DoD agencies.

Releasability: Military Use Only.

TITLE: Ground Wars DATE IMPLEMENTED: 1987.

MODEL TYPE: Analysis.

PROPONENT: U. S. Army Materiel Systems Analysis Activity, Attn: AMXSY-GC, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: Thomas Ruth, AV 298-2924/(301) 278-2924.

PURPOSE: Groundwars is primarily used to evaluate weapon system effectiveness. The model can address ammunition expenditures, acquisition, delivery accuracy, vulnerability, lethality, rate of fire, disengagement policies, effect of line-of-sight due to terrain or obscurants, and the effect of various round types (e.g. KE, HEAT, command-to-line-of-sight, fire and forget, or near simultaneous-engagement type missiles).

DESCRIPTION:

Domain: Land combat between homogeneous forces.

Span: Accommodates any regional area depending on database.

Environment: The model is limited to a total of 20 combatants, including fighting systems and decoys. methodology incorporated includes near-simultaneous fire-and-forget missiles, artillery, multi-target acquisition (attacker groups), line-of-sight enhancements and the ability for tanks to jockey during the engagement process.

Force Composition: Blue and Red homogeneous forces.

Scope of Conflict: Conventional.

Mission Area: All conventional missions.

Level of Details of Processes and Entities: Attrition of ground systems are probability of kill, Monte Carlo based, and output single system kills.

CONSTRUCTION:

Human Participation: None.

Time Processing: Dynamic, event stepped model.

Treatment of Randomness: Stochastic employing Monte Carlo probability theory as its primary solution technique.

Sidedness: Two-sided, symmetric model.

LIMITATIONS: Groundwars simulates only homogeneous forces on each side. The total number of combatants, attacker and defender combined, cannot exceed twenty.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Heterogeneous forces as well as multi-weapon per platform are changes currently planned.

INPUT: None.

OUTPUT: Enhance output with the aid of graphics.

HARDWARE AND SOFTWARE:
Computer: GOULD 9080, VAX-11/780, CRAY X-MP, CRAY II, FHX Alliant or 386 PC.
Storage: 200K.
Peripherals: None.
Programming Language: FORTRAN 77.
Documentation: AMSAA Technical Report 478 "Groundwars 4.0 User's Guide", date October 1989.

SECURITY CLASSIFICATION: UNCLASSIFIED, but data bases are classified.

GENERAL DATA:
Data Base: Scenario dependent - approximately two weeks. Creation of input files: two days - one week. To analyze output: one day - one week.

CPU Time per Cycle: GOULD 9080: 20-25 minutes per 300 replications. FHX Alliant: 45 minutes per 300 replications. CRAY's: 3-5 minutes per 300 replication.

Data Output Analysis: Produces hard copies.

Frequency of Use: Continuous.

Users: USAMSAA, U. S. Army Missile Command, U.S. Army Armor School, Kaman Science Corporation, Rockwell International, U. S. Army Tank Automotive Command, U. S. Natick Research Development and Engineering Center, General Dynamics Land System Division and Surviac operated by Booz, Allen and Hamilton, Incorporation.

TITLE: Guided Artillery Munitions Effectiveness Simulation II GAMES II

DATE IMPLEMENTED: 1991.

MODEL TYPE: Analysis.

PROPONENT: U. S. Army Materiel Command.

POINT OF CONTACT: U. S. Army Materiel Systems Analysis Activity, Attn: AMXSY-GS (Martin Perry), Aberdeen Proving Ground, MD 21005-5071, DSN 298-5030/(301) 278-5030.

PURPOSE: GAMES II is a research and evaluation tool which calculates system effectiveness of most indirect fire artillery indirect fire smart munition concepts.

DESCRIPTION:
Domain: Land.

Span: Single scenario; many munitions against many targets.

Environment: Insensitive to terrain, simulates weather conditions by changing munition acquisition probabilities.

Force Composition: Portrays different types of vehicles in a target array.

Scope of Conflict: Conventional "smart" munitions.

Mission Area: Primarily deep land battle.

Level of Detail of Processes and Entities: Models individual vehicles such as tanks in a moving or stationary target array. By using probabilities of detection/hit/kill it calculates vehicle kills.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, event stepped model.

Treatment of Randomness: Stochastic Monte Carlo simulation.

Sidedness: One-sided.

LIMITATIONS: Since model is event driven, it can not consider the synergistic effects of multiple volleys spaced in time. Target array elements killed continue simulated movement within column.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Target array description: number of vehicles, type, location-including false targets. Target location errors, delivery errors, carrier/submunition reliability. Submunition characteristics: probability of acquisition/hit/kill.

OUTPUT: Average number of munition failures. Number of vehicle acquisitions, hits, kills and the types of vehicles they were.

HARDWARE AND SOFTWARE:
Computer: Digital mainframe or personal computer. Can run on any operating system with only changes in the command file.
Storage: 160 Kilobytes.
Peripherals: Line printer or monitor, magnetic disk tape drive, or hard/floppy drive.
Programming Language: Standard Fortran 77.
Documentation: (Draft user and analyst manual) published as draft AMSAA Technical Report, dated July 1985.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: Depends on the analysis done.

CPU Time per Cycle: Depends on computer being used.

Data Output Analysis: One to two weeks.

Frequency of Use: Continuous at AMSAA.

Users: Primarily AMSAA, also used at Fort Sill, and TRAC WSMR, and by some contractors.

RELEASABILITY: Releasability: Approved for public release; distribution unlimited for most versions of GAMES.

TITLE: Gun Effectiveness Model - GEM DATE IMPLEMENTED: 1980.

PROPONENT: U.S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: John Meredith, DSN 298-6405/(301) 278-6405.

PURPOSE: GEM is a small, simplified model which require a minimum of inputs and computer run time, giving results of sufficient accuracy for used in short turn-around time studies and parameters analyses. The model computes air defense gun system effectiveness against single targets.

GENERAL DESCRIPTION:
Domain: Ground to air.

Span: Individual gun against single, passive target.

Environment: Featureless.

Force Composition: Single air defense gun, single aircraft target.

Scope of Conflict: Conventional.

Mission Area: Air defense.

Level of Detail of Processes and Entities: Computation of kill probabilities are made for a single burst of rounds from the gun, based on the number of rounds, the gun's accuracy and ammunition dispersion, and the target's location and vulnerability. The model consists of four parts. These are (1) the target's state; (2) the gun's aiming errors; (3) the projectile flyout time and dispersion; and (4) the aircraft's vulnerability to the projectile. The projectile's trajectory is computed with the "3/2 Law", the vulnerable areas are represented by a "shoebox", and the probabilities are computed by the salvo, or Carlton, formula.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Generates an expected value of the probability of hit or kill.

Sidedness: One-sided.

LIMITATIONS: Model only considers lethality of a single burst, given a shot.

PLANNED IMPROVEMENTS/MODIFICATIONS: None.

INPUT: Target aircraft location and velocity at time of fire or at time of projectile intercept; Target cardinal direction vulnerable areas; Gun accuracy and ballistic dispersion; Projectile muzzle velocity and drag factor, Number of rounds per burst.

OUTPUT: Target position at time of fire and a time of projectile; Range and remaining projectile velocity at intercept; Projectile time-of-flight; Apparent vulnerable area; Probability of hit or kill.

HARDWARE AND SOFTWARE:
- Computer: Any.
- Storage: 316 lines of FORTRAN coding.
- Peripheral: Input device, printer.
- Programming Language: FORTRAN, BASIC.
- Documentation: AMSAA TR 337, The Air Defense Gun Effectiveness Model, September 1981, AD B059981L.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
- Data Base: Input requires 13 variables.
- CPU Time per Cycle: A few seconds.
- Data Output Analysis: Output contains 7 values.

TITLE: Helicopter Air-to-Air Combat Simulation - HATACS

DATE IMPLEMENTED: September 1978.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity, Attn: AMXSY-AAG, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: Robert Sacco, DSN 298-6396/(301) 278-6396.

PURPOSE: HATACS is used primarily to evaluate the effectiveness of Blue and Red gun systems (both current and proposed) against current and proposed air-to-air threats.

DESCRIPTION:
Domain: Air-to-air.

Span: Local.

Environment: Benign.

Force Composition: One attacker and one target aircraft.

Scope of Conflict: Aircraft Gun systems (up to 40mm).

Mission Area: Close Air Support.

Level of Detail of Processes and Entities: Calculates the probability of Attrition, Forced Landing and Mission Abort Kill categories and the probability of hitting (PH) the target.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Deterministic and generates a value as function of an expected value.

Sidedness: One-on-one with pseudo-dual encounter.

LIMITATIONS: One-on-one, passive target, no terrain, weather or countermeasures.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at this time.

INPUT: Projectile trajectory characteristics, ballistic dispersion, fire control errors, gun rate-of-fire and target vulnerability.

OUTPUT: Produces printout of tables with PKs for the 3 levels of kill (Attrition, Forced Landing and Mission Abort) and PH as functions of Range and Target Aspect Angle.

HARDWARE AND SOFTWARE:
Computer: Runs on CRAY II and Alliant computers with the UNIX operating system.
Storage: 1 MB for executable program.
Peripherals: 1 printer and 1 VT100 terminal.
Programming Language: FORTRAN 77.
Documentation: Thor Informal Report, Y-95, A Description of the HATACS Computer Model, P.H. Beavers, Thor Group, Falcon Research & Development Company for AWD, AMSAA, 28 September 1978.

SECURITY CLASSIFICATION: UNCLASSIFIED, but data can be classified.

GENERAL DATA:
Data Base: Time needed to create one complete weapon-target combination is 4 hours.

CPU Time per Cycle: For a complete set of ranges, kill categories, and target aspects 25 minutes on CRAY II or 4 hours on Alliant.

Frequency of Use: Varies, but is used several times per year in all data request from Army commands for item level performance data.

TITLE: Helicopter Launched Missile Antitank Effectiveness Simulation - HELMATES II

DATE IMPLEMENTED: August 1990.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: William Smith, AV 298-6392/(301) 278-6392.

PURPOSE: To analyze helicopter weapon systems effectiveness and weapon mix effectiveness in a combat environment.

DESCRIPTION:

Domain: Air-to-ground/ground-to-air.

Span: Attack helicopter company vs. ground battalion.

Environment: Terrain features, weather and time of day.

Force Composition: Attack helicopter company vs. ground battalion.

Scope of Conflict: Conventional.

Mission Area: Close air support.

Level of Detail of Processes and Entities: Individual aircraft or ground vehicle is lowest entity. Processes: attrition, communications, and movement effects above entities.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic (event sequenced).

Treatment of Randomness: Stochastic, both Monte Carlo and direct computation.

Sidedness: Force on force.

LIMITATIONS: Blue aircraft only (attack and scout). Red threat limited to 200 vehicles.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Yes, develop new scenarios.

INPUT: Scenarios, weapon characteristics, time lines.

OUTPUT: Killer victim scoreboards, battle time, average exposure times, and kill rates.

HARDWARE AND SOFTWARE:
Computer: CRAY II, VAX.
Peripherals: Input device, printer.
Programming Language: FORTRAN.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: One week to three months.

CPU Time per Cycle: Ten seconds.

Data Output Analysis: One day.

TITLE: Helicopter Operations Model. (HOM)

DEVELOPER: LA2

USER: LA2

PURPOSE: To assess the effectiveness of a fleet of Light Support Helicopters (LSH) under varying conditions and lengths of battle.

GENERAL DESCRIPTION: HOM is an event based Monte Carlo Simulation of LSH operations over a period of several days. A sequence of helicopter tasks are generated, based on wargames, exercises or military judgement, and the ability of the specified LSH fleet to carry out these tasks is evaluated. The tasks are divided into a number of categories, which are, in order of pricrity.

a. Immediate operational tasks whose success depends on immediate execution.

b. 3-hour operational tasks, which must be started within 3 hours of a request reaching the helicopter unit.

c. Air-mobile operations, for which 4 hours notice is given, and which are cancelled if they cannot start within 3-hours of the requested start-time.

d. Logistic tasks, which are only undertaken by LSHs not participating in or committed to other tasks.

The effectiveness of the fleet is measured in terms of the proportion of tasks a-c undertaken and the number of logistic tasks that could have been flown. The model takes account of helicopter numbers, capacity for men or freight, loss rates, reliability and repair times; mission duration, tasking rates and battle durations.

COMPUTER STATUS: Conversion to VAX intended.

DOCUMENTATION: DOAE Note 145/200 dated Nov 1984, DOAE Library Acn No 82311.

TITLE: Helicopter Piloted Air Combat - HELIPAC Model

DATE IMPLEMENTED: 1989.

MODEL TYPE: Analysis.

PROPONENT: Directorate for Systems and Cost Analysis (AMSAV-BA), U.S. Army Aviation Systems Command, 4300 Goodfellow Blvd, St Louis, MO 63120-1798.

POINT OF CONTACT: Roger A. Schleper, DSN 693-1498.

PURPOSE: RESEARCH & EVALUATION TOOL (SYSTEMS EFFECTIVENESS, MIX EFFECTIVENESS, and CURRENT OR NEW DOCTRINE). Model assists in the evaluation of aircraft, armaments, and tactics by simulating the performance of aircraft and weapons in combat.

DESCRIPTION:
Domain: Air.

Span: Local/individual.

Environment: Uses Defense Mapping Agency (DMA) digitized terrain.

Force Composition: Four-on-four model, mixed aircraft (fixed or rotary wing, red or blue).

Scope of Conflict: Primarily conventional air-to-air warfare, but can play red SAMs.

Mission Area: All conventional air combat missions.

Level of Detail of Processes and Entities: Up to four individual systems on each side, all at same level.

CONSTRUCTION:
Human Participation: None required or permitted.

Time Processing: Dynamic, using both time step and event step processing.

Treatment of Randomness: Stochastic, using Monte Carlo techniques.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Low resolution sensor methodology and lack of IR ECM methodology.

PLANNED IMPROVEMENTS/MODIFICATIONS: Addition of a turreted gun, ECM methodology, and the NVEOL model.

INPUT: Engagement scenario data, aircraft descriptions, missile descriptions, firing doctrine and conditions, detection contours, and tactical information

OUTPUT: Reflected inputs, aircraft position and orientation versus time, missile position and orientation versus time, and significant event narrative

HARDWARE AND SOFTWARE:
Computer: Dell System 310, DEC Microvax II, IBM 3090-600
Storage: Requires more than 800K bytes of memory to execute.
Peripherals: Printer.
Programming Language: FORTRAN
Documentation: HELIPAC User's Manual and HELIPAC Analyst's Manual, Sikorsky Aircraft Division, United Technologies Corp.; prepared by Schiller Consulting, Chicago, IL; October 1990.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: Approximately 4 months to acquire and structure data to model format.

CPU Time per Cycle: 1-2 minutes per iteration.

Data Output Analysis: Variable.

Frequency of Use: Project dependent.

Users: AVSCOM, AMSAA, General Dynamics, Sikorsky, and other SURVIAC users.

Comments: Model was developed by Schiller Consulting, Chicago, IL, and is an extension of a previous model series, PACAM (Piloted Air Combat Analysis Model). The principal extension has been the inclusion of rotary-wing aircraft, with all of the aerodynamic, power plant, and maneuver ramifications.

Releasability: Available through SURVIAC.

TITLE: Helicopter Scenario Assessment Model - HELSCAM

DATE IMPLEMENTED: 1989.

MODEL TYPE: Analysis.

PROPONENT: Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Canada K1A 0K2

POINT OF CONTACT: Dr. P.J. Young, (613) 992-4567/AV 842-4567.

PURPOSE: To analyze the value of helicopter system and sub-system characteristics and configurations in light observation, light armed, and attack roles within realistic "few-on-few" tactical scenarios.

DESCRIPTION:

Domain: Land and Air.

Span: Local. HELSCAM is a "few-on-few" class of simulation.

Environment: On and over three dimensional terrain covering approximately 1000 square km in Europe. Designed for mixed open/forested terrain. Accommodates varying visibility and weather conditions.

Force Composition: Helicopter systems, air defenses, and ground combat vehicles of all major types. Individual soldiers can be represented.

Scope of Conflict: Conventional direct fire systems only.

Mission Area: Light observation, armed reconnaissance, and attack helicopter missions in contact with the enemy. Can also simulate scenarios involving only conventional direct fire vehicles and systems.

Level of Detail of Processes and Entities: Vehicles and weapon systems are represented individually. The engagement sequence of each sensor/weapon system is modelled on an event-by-event basis, including the processes of target acquisition, target selection, target engagement, damage recognition, and re-engagement. Kill probabilities are drawn from look-up tables. Communication of target acquisition and destruction information between units on the battlefield is represented. Each system follows a prescribed path, but can advance (or retreat) along that path at a rate determined by events.

CONSTRUCTION:

Human Participation. NOT REQUIRED. Model is an automated simulation.

Time Processing: Dynamic. HELSCAM is completely event stepped.

Treatment of Randomness: Stochastic. Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Units follow prescribed paths, placing a practical upper limit of approximately 30 systems total on both sides and approximately 30 minutes of combat. Shoot-look-shoot engagements only. Unit information never incorrect, only incomplete. Digital terrain data base fidelity limits capability to play out close combat scenarios completely within forested or urban areas. Suppression, training, and morale effects not modelled.

PLANNED IMPROVEMENTS/MODIFICATIONS: Under contract, HELSCAM is being rewritten into C++ and being ported onto a single IBM/PC compatible platform. The representation of ground vehicles will be enhanced to the level of the helicopters in the model, at which time HELSCAM will be renamed the Combat Scenario Assessment Model (COMSCAM).

INPUT: Terrain data in two forms: 100 meter resolution digital terrain elevation and vegetation height data; and 12.5 meter resolution digital terrain classification data. Technical parameters of sensors, weapons, and platforms, including PK tables and target selection priority tables. Also, scenario parameters including unit paths, procedures and tactics.

OUTPUT: Event log, which can be listed from a rudimentary analysis facility, or viewed from a fully developed graphical replay facility.

HARDWARE AND SOFTWARE:

Computer(OS): HELSCAM simulation core and analysis facility runs on a VAX/VMS system. Route planning and graphical replay facilities run on an IBM PC/AT clone with the Verticom M-256E graphics card. Eventually, the core and all utilities will run on a standard VGA-enhanced IBM PC.

Storage: Simulation core uses 3 MB of memory. 12 MB of disk space is desirable to accommodate terrain, input and multiple output files.

Peripherals: Printer, Verticom monitor, Microsoft mouse.

Programming Language: Simulation core in VAX FORTRAN. Graphical Replay and Route Planning facilities written in Microsoft C and Assembler.

Documentation: ORAE Project Reports PR488, PR489. DLOR Staff Notes 89/5, 89/6, 89/8, 89/9, 89/10, 89/11, and 89/12.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Data Base: Several person-weeks to enhance existing data base and develop scenario inputs. Several person months to populate a data base from scratch.

CPU Time per Cycle: Approximately 5 minutes of CPU time on a VAX 11/751 to simulate 30 minutes of combat for 8 units.

Data Output Analysis: Variable, from several hours to several days.

Frequency of Use: Applied periodically (several times annually) in helicopter or direct fire studies.

Users: ORAE/DLOR staff in support of Army study sponsors.

Comments: JANUS, TAM, and HELSCAM are the primary combat models employed in ORAE/DLOR operational research studies.

TITLE: High Energy Laser Weapon Simulation - HELAWS

DATE IMPLEMENTED: July 1981.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity.

POINT OF CONTACT: Director, USAMSAA, ATTN: AMXSY-CS (Mr. Brad Bradley), Aberdeen Proving Ground, MD 21005-5071, AV 298-6231/Comm 301-278-6231.

PURPOSE: A research and evaluation tool used during system development. This program models the propagation of a high-energy pulse as it travels through a turbulent atmosphere and impinges on a target sensor. It is used to evaluate various types of high energy lasers in an anti-sensor role. The primary measure of effectiveness provided by the model is probability of optical or electro-optical sensor damage as a function of range and engagement time. Sensor damage includes surface fogging and/or crazing of glass or plastic by carbon-dioxide lasers (CO_2), bulk cracking of glass by deuteriumfloride (DF) lasers, or Forward Looking Infrared (FLIR) device damage by CO_2 lasers.

DESCRIPTION: HELAWS is a digital, one-on-one, simulation of a high-energy laser in an anti-sensor role.

Domain: Land, sea, air.

Span: Individual component.

Environment: Atmospheric effects.

Force Composition: Element.

Scope of Conflict: Any involving electro-optics; item level.

Mission Area: Direct fire ground-ground, ground-air, air-ground.

Level of Detail of Processes and Entities:
Entity: Item.
Processes: Sensor damage.

CONSTRUCTION:
Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Focused beams only; CO2 and DF lasers only.

INPUT: Laser Weapon Characteristics; Target Sensor Characteristics; Atmospheric/Meteorological conditions; Engagement parameters.

OUTPUT: Detailed echo of input data; a pulse fluence/spot size table; pulse-by-pulse and multiple-pulse damage probability tables.

HARDWARE AND SOFTWARE:
Computer (OS): CRAY-2 (UNIX).
Storage required: 66K.
Peripherals: None.
Programming Language: FORTRAN IV.
Documentation: Draft.

SECURITY CLASSIFICATION: (Model without data) UNCLASSIFIED.

GENERAL DATA:
Database: Several man-weeks to acquire data base; less than one hour to structure data in model input form.

CPU Time per Cycle: 1 - 2 seconds per engagement.

Data Output Analysis: Few minutes.

TITLE: Human Engineering Laboratory Counterair Program - HELCAP

DATE IMPLEMENTED: In-process.

MODEL TYPE: Analysis.

PROPONENT: U. S. Army Laboratory Command, Human Engineering Laboratory.

POINT OF CONTACT: Gordon Herald, DSN 298-5897/(301) 278-5837.

PURPOSE: This is an air battle simulation that deals with the development of soldier-machine interfaces in counterair command and control systems.

The HELCAP simulation has four nodes that are driven by a 30-minute air track and message traffic scenario. The nodes simulated are: 1) an air defense battalion tactical operations center, 2) an automated aviation battalion tactical operations center, 3) a Pedestal-mounted Stinger air defense node, and 4) a generic helicopter simulator node.

DESCRIPTION:

Domain: Land, air.

Span: Regional.

Environment: Terrain cultural features including tactical forces.

Force Composition: Combined Army aviation and air defense forces.

Scope of Conflict: Conventional Red and Blue weapon systems.

Mission Area: Aviation and air defense.

Level of Detail of Processes and Entities: Lowest entities modeled are the fire units, individual helicopter, aviation TOC's, and air defense TOC's.

CONSTRUCTION:

Human Participation: Required for participation for decisions and processes.

Time Processing: Dynamic real-time.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: The geographic area is limited to a division area setting of the simulation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The simulation will be on line in July 1991. Improvements, as required, are anticipated as a result of experimental experience.

INPUT: Scenario to include hostile and friendly forces and message traffic.

OUTPUT: Data related to soldier performance at each node.

HARDWARE AND SOFTWARE:
Computer (OS): VAX 6410(VMS), Silicon Graphics 4D/85GT(UNIX).
Storage: 512MB.
Peripherals: Graphics systems, printers, sensors, keyboards.
Programming Language: FORTRAN, C.
Documentation: HELCAP Design Guide.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: None.

CPU Time per Cycle: .033 seconds.

Data Output Analysis: Post processing.

Frequency of Use: Several times per year.

Users: Human Engineering Laboratory.

TITLE: HELICCS - Hunting Engineering Limited Infantry Close Combat Simulation

DEVELOPER: FS and Hunting Engineering Ltd (HEL)

USER: FS

PURPOSE: To represent infantry close combat in all aspects that have been identified in field trials and historical analysis as influencing battle outcomes.

The model can be used to:

a. Simulate infantry battles in studies involving infantry operations.

b. Generate inputs to higher force level models.

c. Assist in planning field trials (using weapon simulators).

d. Assist in reconstruction of field trials.

GENERAL DESCRIPTION: HELICCS is a stochastic event based simulation of the closing phase of infantry close combat in rural terrain. Battles can be represented between infantry of up to a company in attack and a platoon in defence with, if required, armour and artillery supporting the attack and anti-armour weapons and artillery supporting the defence. The model simulates the movements and engagements by individual men and vehicles in rural environments varying from open, through mixed open and close to wooded or forested terrain, and can take account of the degradation due to the presence of live-fire and of suppression by direct and indirect fire. The model has been calibrated against the results of field trials and historical analysis and validated against historical battles.

COMPUTER STATUS: Available on VAX.

DOCUMENTATION: HEL User and Program Guides for HELICCS - DOAE Library Accession No 90785.

COMMENT: A simplified and faster running model based partly on HELICCS outputs has been produced called SMICC.

TITLE: HELSBELLS 90 - Hunting Engineering Limited's Stochastic Battle Engagement Low Level Simulation

DEVELOPER: FS and Hunting Engineering Ltd (HEL)

USER: FS

PURPOSE: To represent armour anti-armour combat in all aspects that have been identified by field trials, and in particular to incorporate assessments of the effects of thermal imaging (TI) on the armoured battle.

The model can be used to:

a. Simulate armour and anti-armour combat in attack and defence, with weapons using visual or visual and TI sights.

b. Evaluate the effect of TI and thermal camouflage on the armoured battle.

c. Generate input to higher force level models.

d. Assist in planning field trials.

GENERAL DESCRIPTION: HELSBELLS 90 (a development of HELSBELLS with extra capability and for use on VAX) is a stochastic event based simulation of armoured attack on an anti-armour defence. Battles can be represented between attacks of up to battalion level and defence of up to company level. Tanks, ATGW and LAW can be represented. The model simulates the engagement of individual vehicles and weapons moving with defined rules (rapid approach or fire and movement) on defined routes. Intervisibility can be input by a sub-routine using a terrain model or from trials data. The model has been calibrated against the results of the DRAGONS EYE and CHINESE EYE trials.

COMPUTER STATUS: Available on VAX.

DOCUMENTATION: HEL User and Program Guides for HELICCS available from FS.

COMMENT: When historical analysis allows, the model will be extended and calibrated against historical data.

TITLE: IDAHEX DATE IMPLEMENTED:

MODEL TYPE: Analysis. (Is used as a training model at Staff College with Air game TAWS).

PROPONENT: Now maintained by users (or contractor). Formerly, IDA or STC.

PURPOSE: IDAHEX is a computer assisted Wargame used to examine strategy and tactics at Corps level. To achieve this flanking Corps are played. The level can be adjusted upwards to theatre, or reduced but assumptions rely on unit:terrain cell relationships.

(It is used at Camberley to give command decision experience and is played at the Theatre level).

DESCRIPTION

Domain: Land with air effects.

Span: Can accommodate any land. Currently Central Europe.

Environment: Based on hexagons categorised on an open-difficult scale with trafficability and barriers represented at hex-faces. Day and night are modelled.

Force Composition: Mixed ground Units, Artillery and Aircraft.

Scope of Conflict: Primarily conventional and chemical.

Mission Area: All conventional warfare but limited air operations.

Level of Detail: Usually Blue Battlegroups versus Red Regiments. Model assumes contact battles occur completely within a hexagonal grid cell. Ground attrition is calculated from extended Lanchester's equations. Players obtain some intelligence reports, give orders to manoeuvre and combat units and assign air support. Results are by vehicles killed, ground taken.

CONSTRUCTION

Human Participation: Required for decisions, command and control.

Time Processing: Dynamic, time and event stepping. Cycles are played of a fixed length, typically in the range 1-3 hours.

Treatment of Randomness: Deterministic. Some stochastic representation of hex penetration.

Sidedness: Two sided, can be played by 2 or more players and a game control cell. Can be played open or closed.

Limitations: Limited air and logistics. Difficult to represent all forms of intelligence.

Planned Improvements: To obtain IDAHEX (in its analytical role) integrated with an Airgame, TAWS. Alternatively to integrate IDAHEX with CAMAO.

Input: Terrain categories, attrition coefficients, unit composition, movement rates. Orders and Air sortie requests.

Output: Attrition tables, intelligence reports. At Corps plus flanking Corps level graphics.

HARDWARE AND SOFTWARE

Computer: VAX running VMS

Storage: Playing 2.5 Corps. Approx 4000 blocks of Executable code, situation save files at cycles, 7000 blocks Results 500 each.

Graphics additional: Peripherals Min 2 x V220 terminals, 1 priner (Sigmex terminal for graphics)

Programming Language: FORTRAN

Documentation: Currently being written for Staff College.

SECURITY CLASSIFICATION: Code unclassified, some databases classified.

GENERAL DATA

General Data: Data bases take time to assemble. Lower level combat modelling required to define attrition data.

CPU Time Per Cycle: Minimal, however, varying gaps between cycles while players decide orders unless a time limit is imposed.

Data Output Analysis: Limited analytical use of numeric output. Exploratory tool.

Frequency of Use: Several times per year.

Users: DOAE (Staff College).

TITLE: Improved Fire Control Simulation - FIRCON

DATE IMPLEMENTED: February 1990.

MODEL TYPE: Analysis.

PROPONENT: U. S. Army Materiel Systems Analysis Activity, Attn: AMXSY-AAG, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: William Nicholson, DSN 298-6403/(301)278-6403.

PURPOSE: FIRCON is used primarily to evaluate the effectiveness of the Apache and Cobra aircraft vs. Red gun systems (both current and proposed) against current and proposed air-to-air threats.

DESCRIPTION:
Domain: Air-to-air.

Span: Local.

Environment: Geographically based terrain.

Force Composition: One attacker and one target aircraft.

Scope of Conflict: Attacker aircraft gun, rocket, and missile systems; target aircraft gun system only.

Mission Area: Close air support.

Level of Detail of Processes and Entities: Calculates the probability of surviving the engagement at given time intervals.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Deterministic and generates a value as function of an expected value.

Sidedness: One-on-one with pseudo-dual encounter.

LIMITATIONS: One-on-one, target aircraft is limited to gun system only; terrain is an option.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at this time.

INPUT: Projectile trajectory characteristics, ballistic dispersion, fire control errors, gun rate-of-fire and target vulnerability.

OUTPUT: Produces printout of probability of survival for a given time increment.

HARDWARE AND SOFTWARE:
Computer: Runs on CRAY and SEER computers with the UNIX operating system.
Storage: 904288 Bytes for executable program.
Peripherals: 1 printer and 1 VT100 terminal.
Programming Language: FORTRAN 77.
Documentation: Ketron KFR 163-90, Improved FIRCON Simulation, C.M. Frank, R.R. Rudolph, F.M. Wiygul, February 1990.

SECURITY CLASSIFICATION: UNCLASSIFIED, but data can be classified.

GENERAL DATA:
Data Base: Time needed to create flight paths for both aircraft has not been assessed at this time.

CPU Time per Cycle: 1 minute on CRAY II.

Frequency of Use: At this time the model is just beginning to be utilized, but the urgency of the application of this to the evaluation process is pushing us to use it ASAP.

DATE IMPLEMENTED: 03/01/91

TITLE: Intelligence Electronic Warfare Functional Area Model (IEWFAM)

MODEL TYPE: Analysis

PROPONENT: U.S. Army Intelligence Center, Fort Huachuca, AZ 85631-7000

POINT OF CONTACT: Pamela Kiley, Attn: ATSI-CDC-S, AV 879-7212/7213
Fort Huachuca, AZ 85631-7000

PURPOSE: The IEWFAM is a mid-level resolution, VIC based, combat simulation that portrays intelligence functions in terms of collection management, sensors, processing, and jamming. The model supports Combat Development activities in terms of evaluating new doctrine and competing strategies. The IEWFAM is a Research and Evaluation Tool which evaluates sensor, processor, and jammer effectiveness against target sets. The model evaluates IEW force capability and requirements in terms of mix effectiveness.

DESCRIPTION:
- The IEWFAM evaluates sensor contribution in land, air, and space.
- The IEWFAM is a corps level model. The contribution of theater assets is evaluated in an aggregated fashion.
- The IEWFAM utilizes the same 4km terrain hexes utilized by the VIC model. Both day and night are represented, and weather is represented to a limited degree.
- The model plays a Blue corps against a Red army. Combined or joint forces are not specifically represented, but could be.
- The IEWFAM evaluates a conventional scenario. The chemical and biological module can either be turned on or off depending on the desired level of detail.
- ECM, Collection, Collection Management, and Processing and Analysis.
- Units are usually represented at the battalion level. An individual piece of equipment (sensor) can be represented, but it is associated with a parent unit for processes such as attrition and movement. Flight profiles of specific air vehicles are explicitly represented.

CONSTRUCTION:
- Human participation is not required once the simulation has initiated. An interrupt mode has been built into VIC, but it is not normally used when running the IEWFAM. The model is event-driven and changes occur based on an external events file and internal events.
- IEWFAM is an event-stepped, dynamic model.
- IEWFAM is a deterministic model which generates a value as a function of an expected value.
- The IEWFAM is a two-sided model in which all processes are represented for both sides, but data inputs can be varied.

LIMITATIONS: IEWFAM validation is still ongoing, and all limitations have not yet been delineated. Currently, the model is only configured to represent a European environment. Run time is excessivly long.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Planned improvements include: facilitating scenario changes, the inclusion of HUMINT representation through AI means and parrellization of processing to speed up run times.

INPUT: The IEWFAM is extremely data intensive. In addition to the data required for the combat portions of VIC (scenario, weapons, units etc.)

intelligence specific data include: requirements nodes, detectables, detectable thresholds, sensor parametric data, processing queues and thresholds, and initial perceived threat.

OUTPUT: The output is available on magnetic tape which is loaded into an Ingres data base which is part of the IEWFAM post processor. The post processor allows the user to access the data through preprogrammed queries or through adhoc SQL commands. The data can be displayed in tabular format, in relation to a map background, or in common business statistical format.

HARDWARE AND SOFTWARE:

COMPUTER (OS): SUN IV / Unix

STORAGE: Minimum storage requirement is approximately 2 gigabytes

PERIPHERALS: Color graphics monitor or large screen projection system and printer as desired.

PROGRAMMING LANGUAGE: SIMSCRIPT

DOCUMENTATION: Limited documentation is available. Documentation cycle is not yet complete.

SECURITY CLASSIFICATION: The code is UNCLASSIFIED, but the input data is at the secret level and can be upgraded to the SCI level.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Force laydown one man month. System characteristics 1/2 man month.

CPU TIME PER CYCLE: Model currently running approximately 1:1 for limited periods. Hardware RAM drives run time.

DATA OUTPUT ANALYSIS: TBD.

FREQUENCY OF USE: Model is currently being used daily. Expect heavy usage for study support once validation is complete.

USERS: Intelligence Center is the primary user. TRAC-WSMR is using portions of the model to support some studies.

COMMENTS: IEWFAM is closely linked to VIC. IEWFAM cannot run as a stand alone model without the VIC combat driver. Changes to VIC code must be incorporated as they occur.

TITLE: JANUS-Rand DATE IMPLEMENTED: 1988.

MODEL TYPE: Analysis.

PROPONENT: BGWG Section, CA4 Division, RARDE, Fort Halstead, Kent, England, U.K.

POINT OF CONTACT: J. Saunders, CA4, RARDE, Fort Halstead, Kent, U.K., 0959-32222, ext 2924.

PURPOSE: JANUS R is a research and evaluation tool, dealing primarily with weapon systems development and effectiveness. It can also be used to assess force capability and requirements, dealing with courses of action, mix effectiveness and resource planning and can be used for the study of tactics.

DESCRIPTION:

Domain: Land and land/air.

Span: Local.

Environment: Resolution depends on total are included in game e.g. 30km x 30km has 50km resolution and 60km x 60km has 100m resolution. Terrain features include spot heights, 7 types of vegetation, 7 types of building, rivers, roads, bridges, and obstacles. The model can handle any time of day in any weather conditions.

Force Composition: Up to and including Brigade level.

Scope of Conflict: Conventional.

Mission Area: Any conventional missions within the domain.

Level of Detail of Processes and Entities: The lowest entities modelled are individual men, vehicles or aircraft, though men are usually grouped into small teams. Attrition, movement, target acquisition and logistics are modelled for each entity.

CONSTRUCTION:

Human Participation: Required for decisions, though the model would continue to run without a decision.

Time Processing: Processing is dynamic, the model uses event stepping.

Treatment of Randomness: The model is stochastic, it uses the Monte Carlo method.

Sidedness: The model is two-sided and symmetric.

LIMITATIONS: Does not model C3I in any detail.

PLANNED IMPROVEMENTS/MODIFICATIONS: A night model and the introduction of different kill categories are to be introduced. A modification to the graphics is underway to increase the number of colors available. There are some 30 other changes to be made, that have been identified.

INPUT: Terrain data, weather data, system and weapon characteristics including attrition data, mobility data and activity timings, smoke and dust data.

OUTPUT: system status as requested during the game. Records of all direct fire and indirect fire events, mine encounters and detections can be printed. The game can be rerun and limited analysis done. A new post-processor using a database is to be developed.

HARDWARE AND SOFTWARE:
Computer: Designed to run on a VAX computer with a VMS operating system.
Storage: 256 Mb.
Peripherals: The minimum requirement is 2 graphics monitors, 1 printer, and 2 VT series terminals.
Programming Language: VAX FORTRAN.
Documentation: There is a user's guide and a technical description of those changes made since acquisition of JANUS T.

SECURITY CLASSIFICATION: UNCLASSIFIED, database classified SECRET.

GENERAL DATA:
Data Base: About 2 man years for the first study, additional data for subsequent studies depends on study but varies between 1 & 6 man months.

CPU Time per Cycle: Form 3 to 6 minutes of processor time per minute of game time (on a VAX-785).

Data Output Analysis: Postprocessor aids in analysis of output.

Frequency of Use: Either 1 or 2 series of games per year, consisting of about 20 games each.

Users: BGWG section, CA4 Division in response to requests for studies by a series sponsor from within the MOD.

Comments: JANUS R is a development of JANUS T, contacts with TRAC-WSMR are maintained.

DATE IMPLEMENTED: 10/01/90

TITLE: Janus-Army

MODEL TYPE: Analysis and training and education

PROPONENT: TRADOC Analysis Command (TRAC-WSMR), White Sands Missile Range, NM

POINT OF CONTACT: Charles Lee Kirby, ATRC-WEB, (505) 678-4949, AV 258-4949

PURPOSE: Janus-Army has been developed primarily as an analysis tool to support Cost and Operational Effectiveness Analyses, analysis of tactics and doctrine and other Army studies. It is also used as a high resolution scenario generator, GDP evaluator, and CPX driver. Janus-Army development has also responded to the requirement to use the game as a seminar and classroom educational tool for company, battalion and brigade commanders.

DESCRIPTION:
Domain: Land, air and naval support of land operations
Span: Individual system through brigade force
Environment: Time of day, DMA digitized terrain topography, weather conditions, terrain surface features include vegetation, bodies of water, cities, roads and rivers, obscuration, obstacles, and non-persistent chemicals.
Force Composition: Joint and combined forces for both RED and BLUE.
Scope of Conflict: RED and BLUE conventional, some chemical and some unconventional weapons.
Mission Area: Combined Arms Combat including CAS, airlift, ground maneuver and indirect fire weapons.
Level of Detail of Processes and Entities:
Entities: All engagements are resolved at the individual system or soldier level. Units can be homogeneously aggregated to expedite play.
Processes: Janus-Army processes are stochastic. The environment, search and detection, and attrition processes are modeled at the highest level of resolution possible within the constraints of data and hardware.

CONSTRUCTION:
Human Participation: Required for decisions and processes. The game does not wait for a decision to be made.
Time Processing: Dynamic, time preserving event stepped model.
Treatment of Randomness: Stochastic: a combination of direct computation and Monte Carlo techniques.
Sideness: Two sided, asymmetric, with both side capable of reacting.

LIMITATIONS: 600 units per side. Units must be homogeneous, one or more systems.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Simplify data base maintenance; allow heterogeneous aggregate units; and separate initial planning from game execution.

INPUT: Static - Weapon and system operational characteristics, weapons effects, sensor performance (weather dependent), radar performance vs a/c, terrain, smoke and dust parameters (weather dependent), chemical weapon parameters, minefield parameters and effects.
Scenario dependent - force size and composition, initial positions of units, barriers and prepared positions and preplanned artillery.

Dynamic - movement routes, unit states, search sectors, and artillery

OUTPUT: All artillery and direct fire events, all kill events, all minefields encounters and breaching activity by unit, all detection events and all events related to heat stress, protective actions and use of chemicals are recorded on disk. The standard post processor produces summary artillery and direct fire reports, killer victim scoreboard, force loss analysis, system exchange ratios, system contribution, detection scoreboard, and engagement range analysis.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX/VMS

STORAGE: 16 Mbytes (CPU), 500 Mbytes (disk)

PERIPHERALS: 4 - 8 Tektronix 4225 19" color graphic terminals with data tablets, 4 - 8 VT320 terminals, 1 line printer, 2 - 4 table top printers.

PROGRAMMING LANGUAGE: FORTRAN

DOCUMENTATION: 1986 User Manual with updating memoranda.

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Initial preparation, 2 to 4 man months. Updates, 2 to 10 man days.

CPU TIME PER CYCLE: CPU and scenario dependent - MV3800 will run brigade scenarios at real time.

DATA OUTPUT ANALYSIS: Study and analyst dependent.

FREQUENCY OF USE: Continuous

USERS: TRAC-WSMR; TRAC-MTRY; FT Rucker; DLOR, Canada; AWGC and WSRL, Australia; CAD, France; West Point; FT Leonard Wood; I.D.A.; and SOUTHCOM.

COMMENTS: Janus-Army replaces Janus(T). FT Benning; FT Knox; FT Sill; Rand Arroyo; TRAC-WSMR; TRAC-SWC; and RARDE, UK still use Janus(T). Software support for Janus(T) will continue until July 1991. Inquires for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or call AV 552-5511 or commercial 913-684-5511.

TITLE: Low-Energy Laser Weapon Simulation - LELAWS

DATE IMPLEMENTED: July 1981.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity.

POINT OF CONTACT: Dir, USAMSAA, ATTN: AMXSY-CS, B. Bradley, Aberdeen Proving Ground, MD 21005-5071, AV 298-6231/301-278-6231

PURPOSE: A research and evaluation tool used during system development. This program models the propagation of pulse energy from a low-energy laser weapon (or laser range finder or laser designator) through a turbulent atmosphere to a point in the far-field where this energy is received by a target sensor. The target sensor could be the unaided eye, the optically-aided eye, an image intensifier or converter, or a TV system. The primary measure of effectiveness generated by the model is the probability that a given pulse (or train of pulses) reaching the sensor will exceed the damage threshold of the sensor. The model is used primarily for the evaluation of item-level performance of low-level laser weapons in the anti-sensor role. In addition, the model can also be used in laser hazard/safety studies to estimate the level of laser eye hazard associated with low-energy lasers on the battlefield or during training exercises.

DESCRIPTION: LELAWS is a completely digital, one-on-one simulation of a low-energy laser weapon operating in the anti-sensor role. Both land and air-based targets sensors can be in the model. Although the model was designed primarily for the one-on-one engagement, it can be used to predict effectiveness estimates for one laser versus several sensors.

Domain: Land, air, sea.

Span: Individual.

Environment: Atmospheric effects.

Force Composition: Item.

Scope of Conflict: Any.

Mission Area: Direct fire ground-ground, ground-air, air-ground.

Level of Detail of Processes and Entities:

Entity: Item.

Processes: Sensor damage.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Pulsed lasers only; Divergent beams only; Low-energy lasers only (i.e., no thermal blooming); Smoke effects not presently included.

PLANNED IMPROVEMENTS/MODIFICATIONS: We are currently adding CW lasers.

INPUT: Laser weapon characteristics; Target sensor characteristics; Sensor damage thresholds; Atmospheric conditions; Engagement parameters.

OUTPUT: Detailed echo of input data; Laser beam-spreading parameters as a function of range; Tables of sensor damage probability as a function of range, visibility, damage level, and number of pulses fired; Optional output includes power-fading distributions for each of the primary phenomena which affect the laser beam.

HARDWARE AND SOFTWARE:

Computer (OS): CRAY-2 (UNIX), IBM-PC (MS DOS).
Storage required: 47K.
Peripherals: None.
Programming Language: FORTRAN IV.
Documentation: Draft.

SECURITY CLASSIFICATION: (Model without data) UNCLASSIFIED.

GENERAL DATA:

Database: Several man-weeks to acquire data base; less than one hour to structure data in model input format.

CPU Time per Cycle: 1-2 seconds per single engagement.

Data Output Analysis: Few minutes.

DATE IMPLEMENTED: 01/01/79

TITLE: Maintenance Capability Attack Model (MACATAK)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command, Ft Lee (TRAC-LEE)

POINT OF CONTACT: Bruce E. Lasswell, AV 687-1050, Ft Lee, VA 23801

PURPOSE: To measure the survivability and vulnerability of division-level maintenance elements in conventional, chemical, and nuclear environments. The model assesses the effectiveness of the maintenance system as it experiences attacks both on the end item it supports and on the system itself.

DESCRIPTION: This is a stochastic, discrete event, high resolution maintenance simulation created using MAWLOGS Modeling System. It plays multi-echelon maintenance activities with explicit skills, test equipment, and DX or LRU inventories. Lift equipment and ASL-PLL-NSL parts are played generically. Repair actions and combat damage can be represented in great detail.

CONSTRUCTION:
Human Participation: Not required--scheduled changes.
Time Processing: Dynamic, event-step.
Treatment of Randomness: Either stochastic, Monte Carlo or deterministic
Sidedness: One-sided.

LIMITATIONS: Data set can be extensive. Not directly related to combat models.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Number and type of equipment in each using unit; number and MOS of maintenance personnel; inventory of DX components at each maintenance activity; equipment usage rates and failure rates; maintenance action information such as time to repair, frequency of occurrence, and contact teams; time it takes for parts to arrive; scenario.

OUTPUT: Tabular printouts of probable equipment availability; listing of equipment maintenance TAT; TAT broken into function segments; printouts of of queue sizes for parts, skills, and equipment as a function of time. A binary transaction file is created for additional postprocessing.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX 11/780, SUN 4/280.

STORAGE: Variable.

PERIPHERALS: Printer and tape drive.

PROGRAMMING LANGUAGE: FORTRAN 77.

DOCUMENTATION: User's Guide for MACATAK (DLSIE 41425-MA), Programmers' Guide for MACATAK (DLSIE 41425-MB).

OTHER COMMENTS: MACATAK was created using the Models of the Army

Worldwide Logistics System (MAWLOGS).

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: N/A.

CPU TIME PER CYCLE: Varies.

DATA OUTPUT ANALYSIS: Varies.

FREQUENCY OF USE: As needed.

USERS: Proponent; U.S. Army Combined Arms Support Command; U.S. Army Ordnance Missile and Munitions School; BDM Corporation.

COMMENTS: Government agencies can obtain MACATAK with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of MACATAK can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or call AV 552-5511 or commercial 913-684-5511.

DATE IMPLEMENTED: 01/31/91

TITLE: Maintenance Model (MAMO)

MODEL TYPE: Analysis

PROPONENT: U.S. Army Combined Arms Support Command (USACASCOM), Ft Lee VA

POINT OF CONTACT: Dr. James Blowers, CASCOM, ATTN: ATCL-OMM, AV 687-3063

PURPOSE: Model the wartime operation and maintenance of wheeled vehicles in a heavy Division slice through EAC. Designed for the primary purpose of determining maintenance manpower requirements.

DESCRIPTION:
Domain: Heavy division slice of a corps throught EAC, land only.
Span: Division slice through EAC.
Environment: Time, usage profile (stop, move, idle).
Force Composition: Wheeled vehicles.
Scope of Conflict: Conventional.
Mission Area: Weapons not modelled.
Level of Detail: Individual vehicle operation and maintenance.

CONSTRUCTION:
Human Participation: Not required, not permitted once run submitted.
Time Processing: Dynamic discrete event.
Treatment of Randomness: Deterministic, generates values based on distribution.
Sideness: One-sided.

LIMITATIONS: No geography. No combat damage.

PLANNED IMPROVEMENTS AND MODIFICATIONS: User's Guide, Mar 91

INPUT: Comprehensive LIN maintenance data, usage data, force structure, part availability and delay.

OUTPUT: Annual maintenance man-hours by level of maintenance by MOS by LIN Operational availability, wait and queue length data.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX 11/780, VMS

STORAGE: Model + data + to run = 10,000 blocks/ 500k bytes data arrays etc. virtual

PROGRAMMING LANGUAGE: Discrete Event SLAM (FORTRAN)

DOCUMENTATION: User's Guide (Mar 91), Model documentation (Jan 91)

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: As updates require

CPU TIME PER CYCLE: 4 hours 24 minutes to run 30 days

DATA OUTPUT ANALYSIS: 4 hours

FREQUENCY OF USE: As required

USERS: CASCOM, OC&S

COMMENTS: Originally developed to support MARC program.

TITLE: Maritime Campaign Program (MCP) DATE IMPLEMENTED: 1982

MODEL TYPE: Analysis

PROPONENT: DOAE (some program maintenance work contracted out to CORDA)

POINT OF CONTACT: John G Owen, Byfleet Mil or 09323 41199 ext

PURPOSE: MCP is a theatre level model of naval operations, used to evaluate the performance of different force mixes with different weapon system fits.

DESCRIPTION:

Domain: Sea and related Air operations.

Span: Theatre level; any theatre depending on data base.

Environment: Network based; nodes represent different sea or coastal areas or land areas which contain air bases. Nodes have different environment types for ASW purposes, and different probabilities of being able to resupply at sea; these are constant throughout the war.

Force Composition: Any combination of the vessel and aircraft types represented in the scenario, BLUE and RED.

Scope of Conflict: Primarily conventional anti-ship, anti-submarine, anti-aircraft and airfield attack weapons. Nuclear weapons can be played, but only their immediate effects on units and bases represented.

Mission Area: Sea control, OTC group operations, anti-submarine barrier and sweep operations, anti-shipping airstrikes, counter-air interdiction, combat air patrol, interception.

Level of Detail of Processes and Entities: Individual ships and submarines, each having a specified weapons fit, are modelled. Vessels are combined into groups for movement and combat purposes but firing, munition consumption and losses are assessed for each individually. Aircraft are assigned to missions, consume munitions and take losses individually.

CONSTRUCTION

Human Participation: Once the scenario data files have been set up, the model is usually run without human intervention. However, there is an interactive mode which allows the user to change units' orders during the campaign, overriding those which the model would otherwise take from the data files.

Time Processing: Dynamic, event stepped model.

Treatment of Randomness: Stochastic, Monte-Carlo based. Random variation applied to movement times. All detection Monte-Carlo based on data parameters for the different types of detection. All attrition is Monte-Carlo based on probabilities of kill by individual weapons. Model runs normally 400 replications of the campaign.

Sidedness: Two-sided, symmetric.

Limitations: Does not model logistics, except for ship munition supplies. Does not model command, control and communications (except insofar as elements are built into the scenario design).

PLANNED IMPROVEMENTS/MODIFICATIONS: Consideration is being given to including logistics and C3 modelling.

INPUT: Theatre data - node positions and interconnections, ASW environment type. Craft type data - weapon fit, loading and kill probabilities, sensor fit and capability, firing policy, speed. Group data - composition, deployment, orders, contingency orders. Air data - air base complements (including carriers), aircraft allocation to tasks, aircrat weapon fit and capability. Mine data - positions and capabilities.

OUTPUT: Tables of cumulative statistics over all replications - killer/victim scoreboards by target type or group, firer craft type, group or weapon type; munition consumption; craft survival times; numbers of attacks and air raids.

HARDWARE AND SOFTWARE

Computer: Currently runs on a VAX computer with a VMS operating system.

Storage: Approximately 100,000 blocks (50 megabytes) not including databases.

Peripherals: Minimum 1 terminal and 1 printer. Interactive mode also required 1 SIGMEX graphics terminal. Plotter output can also be produced.

Programming Language: FORTRAN 77. Graphics use GKS routines.

Documentation:

1. DOAE Memorandum M82105, October 1982, DOAE MCP Summary Description.

2. DOAE Memorandum M83101, November 1983, DOAE MCP Model Description.

3. Various DOAE papers describing specific model improvements since 1983.

SECURITY CLASSIFICATION: Model code UNCLASSIFIED.

GENERAL DATA

Time Requirements:

Data Base: Preparation of a complete data set from scratch, including scenario development, can take many man-months. Updating or refining a scenario for a new study, several man-weeks of effort.

CPU Time per Cycle: 400 replications of a 10-day campaign takes 1½ hours CPU time.

Data Output Analysis: Produces summary tables of cumulative results over replications, usually as hard copy. Some post-processor programs.

Frequency of Use: In continual use at DOAE.

Users: DOAE (Maritime Campaign Analysis Section)

Comments: Input data on sensor and weapon performance drawn from more detailed lower level models run at DOAE and elsewhere.

DATE IMPLEMENTED: 02/01/91

TITLE: Medical Evacuation MARC Model (MEDEVAC)

MODEL TYPE: Analysis

PROPONENT: U.S. Army Combined Arms Support Command (USACASCOM), Ft Lee VA

POINT OF CONTACT: Gerard Petet, CASCOM, ATTN: ATCL-OMM, AV 687-1845

PURPOSE: This analysis provides a valid/auditable method of determining the Manpower Requirements Criteria (MARC) for medical evacuation (MEDEVAC) operations in a European, mid-intensity conflict scenario. This study provides the factors required to determine the minimum number of essential MOS 67J - Helicopter Crew Chiefs; MOS 153B/D - UH1H/UH60 Helicopter Pilots; MOS 91A - Medical Specialists; and MOS 91B - Medical NCO's that are needed to staff medical evacuation units in order to accomplish their wartime mission.

DESCRIPTION: To determine MARC requirements, a complex model was developed using the Simulation Language for alternative Modeling (SLAM). This model simulates a division slice through the Echelon Above Corps (EAC) and the patient flow from the Foward Line of Troops (FLOT) to the COMMZ Hospital using both air and ground ambulances in a wartime environment. The total operational hours per day per air and ground ambulance required for MEDEVAC were recorded by type air/ground ambulance for each level (CP, BAS, BSA, etc.). These operational hours, in addition to APMMH were used to determine MOS requirements.

CONSTRUCTION: No human participation required during simulation run. Model is interruptable, dynamic (event-step form), stochastic and two-sided (symmetric).

LIMITATIONS: Division slice of corps. 30 day - no warmups. Five air and five ground ambulances maximum.

PLANNED IMPROVEMENTS AND MODIFICATIONS: User's Guide Dec 90.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX 11/780

STORAGE: 3,000 blocks

PERIPHERALS: Printer

PROGRAMMING LANGUAGE: SLAM, FORTRAN

DOCUMENTATION: User's Guide, Dec 90

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 8 hours

CPU TIME PER CYCLE: 30 minutes

DATA OUTPUT ANALYSIS: 1 hour

FREQUENCY OF USE: Continual

USERS: Academy of Health Sciences, CASCOM

TITLE: Micro FASTAL   Date Implemented: 1987.

MODEL TYPE: Analytical.

PROPONENT: U.S. Army Concepts Analysis Agency, Attn: Forces Directorate, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Mr. Raymond G. McDowall, (AV) 295-1658.

PURPOSE: The objective of Micro FASTALS is to develop the balanced support force requirements for a specified combat force Micro FASTALS is used primarily for force in a contingency type operation Micro FASTALS was developed from the larger FASTALS model and designed to run on a personal computer using a spreadsheet format.

DESCRIPTION:

Domain: Land.

Span: Each run accommodates one theater with a specified combat force in a combat scenario.

Environment: Theater dependent.

Force Composition: Specified by study sponsor and used to generate requirements for Army logistical units.

Scope of Conflict: N/A.

Mission Area: Micro FASTALS is a deterministic computer program that was developed to generate the Army support requirements that result from a given combat simulation in a small theater.

Level of Detail of Processes and Entities: Support requirements are generated for each unit type (functional area) including engineer, chemical, medical, transportation, ordnance, quartermaster, et al, by Standard Requirements Code (SRC). The workload requirements needed to sustain the forces are also generated and displayed workloads include maintenance, construction, supply consumption, transportation, patient care, personnel replacements, other.

CONSTRUCTION:

Human Participation: All inputs are developed by functional area analysts prior to model execution. No interaction is permitted during model execution.

Time Processing: Dynamic, one time period.

Treatment of Randomness: Deterministic.

Sidedness: One sided.

LIMITATIONS: Generalized theater network (single region); no time-phasing of requirements; no attrition to combat/support units, single movement of units and supplies from point of arrival in theater to destination.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The model will be expanded to handle 700 units (up from 300) and be able to generate a time-phased troop list similar to the larger FASTALS models.

INPUT: The following data base in magnetic tape form are used. Military Traffic Management Command weights file, Army MARC Maintenance Data Base, Force Accounting System Unit data, and Consumption factor data (provided on floppy disks) from the U.S. Army Logistics Center.

OUTPUT: Force listing is in the form of a troop list indicating unit requirements by SRC.

HARDWARE AND SOFTWARE:
Computer: IBM AT or equivalent.
Storage: 1.5 megabytes.
Peripherals: Standard or high density disk drives.
Language: LOTUS 123.
Documentation: User's Manual.

GENERAL DATA:
Data Base: One man-week or more depending on size for force and complexity of theater being evaluated.

CPU Time Per Cycle: Five minutes.

Data Output Analysis: Two days or more depending upon theater.

Frequency of Use: Used approximately 10 time per year for quick reaction analyses.

Users: USACAA, U.S. Army Logistics Center, U.S. Army Logistics Evaluation Agency.

Comments: This model has been used for 3 years to develop the support force requirements for the Army.

Sidedness: One sided.

LIMITATIONS: Generalized theater network (single region); no time-phasing of requirements; no attrition to combat/support units, single movement of units and supplies from point of arrival in theater to destination.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The model will be expanded to handle 700 units (up from 300) and be able to generate a time-phased troop list similar to the larger FASTALS models.

INPUT: The following data base in magnetic tape form are used. Military Traffic Management Command weights file, Army MARC Maintenance Data Base, Force Accounting System Unit data, and Consumption factor data (provided on floppy disks) from the U.S. Army Logistics Center.

OUTPUT: Force listing is in the form of a troop list indicating unit requirements by SRC.

HARDWARE AND SOFTWARE:
Computer: IBM AT or equivalent.
Storage: 1.5 megabytes.
Peripherals: Standard or high density disk drives.
Language: LOTUS 123.
Documentation: User's Manual.

GENERAL DATA:
Data Base: One man-week or more depending on size for force and complexity of theater being evaluated.

CPU Time Per Cycle: Five minutes.

Data Output Analysis: Two days or more depending upon theater.

Frequency of Use: Used approximately 10 time per year for quick reaction analyses.

Users: USACAA, U.S. Army Logistics Center, U.S. Army Logistics Evaluation Agency.

Comments: This model has been used for 3 years to develop the support force requirements for the Army.

TITLE: Minefields and Barriers Combat Simulation - MBCS

DATE IMPLEMENTED: 1980.

MODEL TYPE: Analysis.

PROPONENT: CA4 Division, RARDE, Fort Halstead.

POINT OF CONTACT: N. Roberts, RARDE ext 2289.

PURPOSE: Research and Evaluation of weapon systems effectiveness.

DESCRIPTION:

Domain: Land.

Span: Local (typically up to 10km front).

Environment: Digitized terrain, representing relief, vegetation and man-made cover, 100m resolution.

Composition: Heterogeneous direct fire units, and "off-table" artillery.

Scope: Conventional.

Mission Area: Direct fire battle.

Level of Detail: Individual vehicles and GW teams represented. Location and state of all relevant mines also represented individually. Direct fire attrition is modelled in detail to the individual firing and impact. Each mine encounter explicitly modelled. Movement is along preplanned routes, with speed and acceleration governed by a simply mobility algorithm.

CONSTRUCTION:

Human Participation: Not required or permitted.

Time Processing: Event sequenced.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Limited number of GW types represented (i.e. only CLOS and ripple-fire Passive Homer). No infantry or helicopters represented. No C3I.

PLANNED IMPROVEMENTS: None.

INPUT: Vehicle characteristics (weight, power, dimensions, minefield countermeasures fitted); Weapon characteristics (range, time of flight); Minefield and barrier data (location, mine density, etc.); Orbat, deployment, routes, orders; Probability data (mine lethality, hit and kill probabilities for DF systems, artillery and APGMs).

OUTPUT: Killer/victim tables, by replication and averaged; Firer/target tables; Shots/kills by range; Mine encounter and result statistics; Event tract (i.e. blow by blow account of the battle).

HARDWARE AND SOFTWARE:
Computer/OS: VAX/VMS.
Storage: 70Mb (130,000 Blocks).
Peripherals: No special requirements.
Language: FORTRAN IV, reconditioned to FORTRAN 77.
Documentation: User's guide, Programmer's guide, model definition.

CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Time Required:
Data Preparation: Several weeks.
LOS Preprocessor: 50 CPU hrs.
Preprocessor (exc LOS): 2 CPU hrs.
Simulation: ~1 1/4 hrs per replication for 30 minute battle.
Analysis Package: Minimal.
NB Timings are based on a complex main defensive action scenario.

Frequency of Use: Rare.

Users: CA4 Division RARDE. AMSAA have a version which differs in several respects, specifically artillery and allowed size of forces.

TITLE: Model of Aggregated Central Region Operations. MACRO

TYPE: Analytical.

PROPONENTS: LA2, DOAE. SHAPE Technical Centre

POINT OF CONTACT: H Moran, LA2, DOAE

PURPOSE:

MACRO is a research and analysis tool which deals with force capability and requirements. It can look at mixes of forces and/or force effectiveness, as well as absolute magnitude of forces. This latter allows it to be used for policy study in the field of arms control.

DESCRIPTION

Domain: MACRO is primarily a Land model with limited representation of some air operations.

Span: MACRO is a theatre/regional model.

Environment: MACRO models almost no environmental features. Options include various treatments of night.

Scope of Conflict: MACRO models conventional warfare, but is sufficiently flexible to be used to model some aspects of nuclear and chemical warfare.

Mission Area: MACRO models the aggregated effects of Corps-level combat.

Level of Detail: MACRO uses an abstract 'points' system, but these are calculated directly from the numbers of tanks, APCs and so on in the ORBAT. Aircraft are treated individually. The lowest level of entity individually recognised by the model is the Corps (in some cases, the model has been used to reflect divisional level combat however). The model includes attrition, FEBA movement and commitment of reserves.

CONSTRUCTION

a. Human participation is not required. The model is not interruptable, but a data file does exist to change states within the model during a run.

b. The model is a dynamic time stepping model.

c. The model is a basically deterministic tool.

d. The model is two-sided.

LIMITATIONS

The model has very little detail.

PLANNED IMPROVEMENTS/MODIFICATIONS

My own current version of the model differs from the original implementation in that while the original models attack helicopters as an explicitly Corps-level asset, I have subsumed them into the ground strengths to free a 'slot' for the consideration of new weapons.

Within LA2 three further modifications are planned/have been implemented. These are a graphics facility to show what is going on, a facility to allow reserves to be deployed across corps boundaries, and a Blue counter-attack facility.

INPUT

Strengths for each corps, depth of defensive belts, effectiveness of air sorties, arrival time and strength of reinforcements, parameters for repair and reconstruction of destroyed units.

HARDWARE AND SOFTWARE

Computer: Currently running on a VAX/VMS system.

Storage: The program is around 900 blocks; input data around 30-60 blocks dependent on number of corps being modelled, and the number of during-run changes. The output is dependent on the length of war, and is about 10 blocks per day.

Peripherals: Keyboard and screen to get the data in, and printer to get it out again.

Programming Language: FORTRAN 77

Documentation: 'High Level Modelling of the Central Region Ground Battle'. P Harreschou. STC TN-013 FILE REF 9980 DOAE Lib 84193

Security Classification: Unclassified, although data may be restricted or higher, as will the corresponding output.

GENERAL REQUIREMENTS

Data Base: With a basecase in front of you gross changes can be made quickly and easily, although certain calculations to put everything into MACRO strength point terms are necessary.

CPU Time: 45 seconds to run a five corps war for twenty days.

Output Analysis: Anything from simple study of FEBA movement to advanced tracing of the battle.

Frequency of Use: 500 times in the last year, and at least 50 in support of the next project.

Users: Several within DOAE, STC, IABG.

Comments: An attempt is being made within DOAE to link MACRO to the CAMAO air-campaign model.

TITLE: Modern (Air Defense) Gun Effectiveness Model - MGEM

DATE IMPLEMENTED: 1981.

PROPONENT: U.S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: John Meredith, DSN 298-6405/(301) 278-6405.

PURPOSE: MGEM is a Monte Carlo simulation of an air defense gun which utilizes a Kalman filter in a digital fire control. The model computes gun system effectiveness against single targets.

GENERAL DESCRIPTION:

Domain: Ground to air.

Span: Individual gun against single, passive target.

Environment: Featureless.

Force Composition: Single air defense gun, single aircraft target.

Scope of Conflict: Conventional.

Mission Area: Conventional.

Level of Detail of Processes and Entities: Computation of kill probabilities are made for a single or multiple bursts of rounds from the gun. The basic block of the model are the sensor, the fire control computer, the gun and turret servomechanisms, the projectile flyout, and the damage assessment. The target state is estimated from Modern Control Theory by Kalman filter, and prediction can be either first or second order. The projectile's trajectory is computed with the "3/2 Law", and the vulnerable areas are represented by a "shoebox".

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Time step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Model only considers lethality of bursts, given bursts are fired.

PLANNED IMPROVEMENTS/MODIFICATIONS: None.

INPUT: Target aircraft position, velocity and acceleration as a function of time. Target cardinal direction vulnerable areas. Ballistic dispersion. Projectile muzzle velocity and drag factor. Firing doctrine.

OUTPUT: Probability of hit and kill as a function of range. Ammunition expended as a function of range. Gun system accuracy.

HARDWARE AND SOFTWARE:
Computer: Any.
Storage: 30K words of core.
Peripheral: Input device, printer.
Programming Language: FORTRAN.
Documentation: AMSAA TR 360, The Air Defense Modern Gun Effectiveness Model, September 1982, AD B065379.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: Input requires 12 variables.

CPU Time per Cycle: 15 minutes on UNIVAC 1110.

Data Output Analysis: Output contains 1 Page of values.

Title: NATO Deployment Model (NDM) Date Implemented: 1971

Model Type: Analysis

Proponent: Defence Operational Analysis Establishment (DOAE)

Point of Contact: Technical Advisory Group

Purpose: The NDM is a high level model for calculating how a defending ground force can be deployed geographically to meet a range of possible enemy attacks in the most effective way. The model uses an iterative mathematical programming approach to represent the non-linearities of high level combat and produce an optimal answer with the formulation.

DESCRIPTION

Domain: Land with some tactical air support
Span: Designed originally as the theatre level model, it can also be used at lower level.
Environment: Relative differences in combat effectiveness are modelled as a function of the geographic area.
Scope of Conflict: The model has been designed and used for assessing conventional conflicts but could be used to represent some aspects of conflict in a chemical or nuclear environment.
Level of Detail: Analytical relationships derived from detailed simulations represent key combat effectiveness parameters for rates of movement by attacking forces and the capability of defenders. Ground forces on each side are modelled as aggregated force units at whatever level is considered appropriate for the study in hand. For the air forces, individual sorties are modelled in support of ground forces.

CONSTRUCTION

a. Human participation is not required. The model is not interruptable and changes to decision processes need to form part of the input data.

b. The model steps forward in a small number of time periods which are defined in the input.

c. The model is essentially deterministic, using a "mini/max" approach to the range of possible enemy attack plans.

d. The model is two-sided.

LIMITATIONS

As a high level model, many features are aggregated to focus attention on key elements. There is no explicit representation of logistic support which is contained implicitly in the force units represented and the relative combat effectiveness calculated accordingly.

PLANNED IMPROVEMENTS/MODIFICATION

The model has recently been retested in the CFE and post CFE context and a graphics facility added to enhance the visual perception of its data set and output.

INPUT

Total available forces for the attacker and defender, with relative combat effectiveness, movement rates, number and effectiveness of close air support sorties, potential reserve locations, movement speeds, decision and planning times for reserve forces.

OUTPUT

The graphics showing air and ground forces deployment and movement can be supplemented with hard copy output on the data sets and the optimal solution from the mathematical programme.

HARDWARE & SOFTWARE

Computer: Currently running on a VAX/VMS system and under MS DOS on PC.
Storage: 4MB RAM and minimum 20 MB hard disc for PC use.
Peripherals: VGA graphics terminal and lineprinter.
Programming Language: Matrix Generator in FORTRAN 77
MPS format for LAMPS LP package
Graphics run under WINDOWS 2.0

Documentation:

1. NATO Deployment Model 1971 Version DOAE Memo 7210 April 1972.
2. NATO Deployment Model Graphical Interface - Source and Data Listings August 1990.
3. User Guide to the NATO Deployment Model Graphical Interface - CD 1095/7/2/TU1/1 July 1990.

Security: Unclassified, although data may be higher, as will the output.

DATE IMPLEMENTED: 11/15/90

TITLE: Network Assessment Model (NAM)

MODEL TYPE: Analysis

PROPONENT: U.S. Army Signal Center, Directorate of Combat Developments, Concepts & Studies Division, ATTN : ATZH-CDC (Studies Branch), Fort Gordon, GA 30905-5090

POINT OF CONTACT: Commander, U.S. Army Signal Center, ATTN: ATZH-CDC (CPT A. Tabler), Fort Gordon, GA 30905-5090 AV 780-3782 COMM 404-791-3782

PURPOSE: The Network Assessment Model (NAM) is a high-resolution tactical communications simulation for the combat developer. NAM allows the analyst to simulate the deployment of C4 equipment and communicators via a digitized terrain map, design single and multichannel radio networks, and evaluate network performance against known communications requirements. NAM's flexible design supports the analysis of communications issues including network architectures, current/new doctrine, equipment trade-off, equipment reduction, terrain evaluation, and force design (TO&E).

DESCRIPTION: NAM simulates the performance of the Army's current and planned tactical communications systems: Mobile Subscriber Equipment, SINCGARS, IHFR, JTIDS, EPLRS, TRI-TAC (EAC-CIP). NAM emulates the generation and completion of calls between battlefield users throughout all Battlefield Functional Areas (BFAs).

NAM handles a wide variety of scenario resolutions. Via roll-up techniques, a single instrument or an entire Division can act as the smallest entity. Typically, a Division- or Corps-level scenario is modeled with phone/radio/Battlefield Automated System instrument pools called Operational Facilities (OPFACs) forming the smallest entity.

NAM uses Defense Mapping Agency (DMA) DFAD level-1 or DTED digitized terrain data coupled with the Terrain Integrated Rough-Earth Model (TIREM) propagation algorithn to evaluate radio link performance between 2MHz and 20GHz. NAM computes the effects of Red jammers, terrain and distance that reduce or elimate radio link throughput.

NAM simulates both air and ground communicators. NAM normally models Army-only units. NAM can also model joint and allied users interfacing with Army networks if customized OPFACs and associated needlines are built.

NAM has been developed in a modular format. As new communications systems are proposed, a corresponding module can be inserted.

CONSTRUCTION: NAM emulates the decisionmaking process the Signal Planner employs in supporting Theater-and-below battlefield communicators. Using a menu/mouse-driven interface, the analyst deploys Operational Facilities (OPFACs) that describe the tactical clustering of C4 users and equipment. After the networks linking these OPFACs have been engineered, the traffic offered to the network by the OPFACs' subscribers is generated and subsequently evaluated, resulting in 16 types of call failure/success codes.

NAM has five major modules. MAINTENANCE supports the building and modifying of the OPFAC library, and the extraction of communications needlines. SIMBUILD facilitates Blue OPFAC laydown, network engineering, and Threat EW deployment. SIMRUN schedules, routes, and evaluates the the networks' throughput. TACTICAL SITUATION DISPLAY graphically portrays the networks' performance over time. POSTSIM displays summary statistics. NAM is a two-sided, asymetric model in that only the Red EW is portrayed.

Most interactive works involves OPFAC laydown. The analyst can stop, adjust, and re-start the scenario to account for the physical destruction or degradation of signal nodes and OPFACs.

NAM's primary engine is a dynamic, event-step call scheduler. Calling rates are based on frequency of transmission values described in the Communications Data Base (CDB) needlines. A negative exponential distribution provides the scheduling for the calls to be initiated and evaluated.

LIMITATIONS: 5000 DNVTs, 2000 OPFACs, 500 MSE Nodes, 100 SINCGARS Nets. Other limits are hardware dependant. Nodal/OPFAC physical attrition is not portrayed. NAM's TIREM implementation does not account for foliage effects.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Planned enhancements include: upgraded EPLRS module with NCS and intercommunity portrayal, the ability to bulk load scenarios, revised threat display, EMC/co-site interference.

INPUT: OPFAC locations (type and quantity of C4 equipment), CDB needlines describing amount and type of transmissions between communicators, Communications backbone and extension node locations, communications equipment characteristics (power settings, antenna heights, sensitivity, data rates, precedence, trunk capacity, etc.) , BAS characteristics (data rate, auto baud detect), DMA digitized terrain.

OUTPUT: Call completion logs, call routing logs, communications node and activity level logs are generated. These logs can be processed by POSTSIM and Tactical Situation Display (TSD) which then graphically display the performance of the network(s) under evaluation. Color graphics include bar charts, pie charts and maps with network diagram and throughput/ channel occupancy overlayed.

HARDWARE AND SOFTWARE:

COMPUTER (OS): Silicon Graphics Inc. (SGI) 4D-series Graphics Workstations' Unix System V (IRIX).

STORAGE: Memory: 8 MB RAM Disk Storage: 17 MB executable code and (min) 10 MB for OPFAC, CDB, DMA terrain files, NAM input files.

PERIPHERALS: RGB Video Printer (Optional). Relational Data Base Management Software (RDBMS) package (Optional-highly recommended).

PROGRAMMING LANGUAGE: C+ with SGI-specific graphics extensions

DOCUMENTATION: Executive Summary, Methodology Manual, User Handbook, Program Maintenance Manual

OTHER COMMENTS: The simulation input module also runs on the SGI 3000-series workstations, but is limited in capacity and processing speed.

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: Preparation is scenario dependent. Turnaround time greatly reduced if end-users provide detailed scenario inputs: units, locations

CPU TIME PER CYCLE: Dependent on number of networks and nodes deployed. For a Division-level scenario, 1 hour simulated time = 5 minutes

DATA OUTPUT ANALYSIS: With an RDBMS package, call logs and other output files can be tied to input for many follow-on investigations

FREQUENCY OF USE: Scenario dependent.

USERS: The Signal Center is the primary user, however, copies of NAM software have been sent to other DoD groups for their evaluation.

COMMENTS: Model turnaround time is extremely dependent on the amount of high-resolution input data provided by the end-user. To improve turnaround the end-user should have a troop list with units (SRCs) and Operational Facilities (OPFACs) already found in the CDB and NAM's customized OPFAC Library. Preparation time increases if customized OPFACs and needlines have to be created.

TITLE: Nuclear Fire Planning and Assessment Model III
NUFAM III

DATE IMPLEMENTED: 1986.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Mr. R. Barrett, (AV) 295-1670/(301) 295-1670.

PURPOSE: Research and evaluation tool for corps and theater-level analysis. Used to support requirements and capability assessment studies of tactical nuclear forces arrayed in context of a theater battle.

DESCRIPTION:

Domain: U.S. and opposing land and air forces on a corps-sized frontage. Depth to 500 km from FLOT.

Span: Corps level model is routinely run for multiple corps to yield theater-level results.

Environment: User defines unit locations to model based on terrain, posture and scenario. Model does not represent terrain features. Population centers are included for civilian damage/casualty avoidance.

Force Composition: Unit sizes are defined in data base. Intended for company or battalion representation of units. Both Red and Blue units represented.

Scope of Conflict: Nuclear only. Models one or more nuclear pulses occurring within a short period of time (?12 hr). Unit locations remain fixed, although the effect of movement is implicitly represented. No conventional attrition occurs during simulation, but should be reflected in unit strength prior to nuclear use.

Mission Area: Nuclear only.

Level of Detail of Processes and Entities:

Entities: Company or battalion maneuver unit; artillery and missiles by firing section or launcher, aircraft by sorties from airbases. Defined in data base.

Processes: Target acquisition, detailed fire planning, execution of nuclear pulses, assessment of damage to units. Movement implicitly represented. Damage represented is radiation to personnel and blast to equipment. No fallout.

Weapons and effects are defined through data base to allow new weapons to be represented. Fire planning criteria defined through data base to allow for variations in fire doctrine.

Time: Discrete event driven model.

CONSTRUCTION:

Human Participation: Not required outside of preparation of input data.

Time Processing: Dynamic event step.

Treatment of Randomness: Stochastic (Monte Carlo). Ten runs are normally required to yield reasonable means.

Sidedness: Two-sided, symmetric in logic, asymmetric in data output values and data driven doctrine.

LIMITATIONS: No conventional or chemical play. No explicit movement of units.

PLANNED IMPROVEMENTS AND MODIFICATION: Complete revision of model to produce a computationally stochastic, PC-based model is planned for completion in early FY91.

INPUT: Unit locations and characteristics; nuclear weapons characteristics and effects. Parameters defining acquisition, movement, and fire planning logic. Size and location of population centers.

OUTPUT: Post-processor produces 30 reports. Typical results are units acquired, engaged, and defeated; weapons selected and fired.

HARDWARE AND SOFTWARE:

Computer: UNISYS 1180/84.
Storage: 230K (main); 140K (extended).
Peripherals: Calcomp plotter.
Programming Language: SIMSCRIPT II.5.
Documentation:

- CAA-D-86-2, NUFAM III User's Manual
- DTIC AD#B113173L

SECURITY CLASSIFICATION: UNCLASSIFIED without data.

GENERAL DATA:

Data Base: Data base prep: 1 - 6 weeks depending on number of excursions, etc.

CPU Time Per Cycle: Two-hours per repetition; 20-hours per excursion.

Data Output Analysis: Currently can produce up to 30 pre-defined reports. Post-processor package (NUFAM-GAP) allows free-form database queries and graphic displays.

Frequency of Use: Support in 1 to 5 studies/year.

Users: U.S. Army Concepts Analysis Agency.

Comments: None.

TITLE: OPALS DATE IMPLEMENTED: 1990.

MODEL TYPE: Training and Education.

PROPONENT: Australian Army War Game Centre.

POINT OF CONTACT: Project Leader AWGC 62-2-9604411.

PURPOSE:
Analytical: Yes.

1. Research & Evaluation
   a. Weapons Systems
      Systems Development?
      Systems Effectiveness?
   b. Force Capability and Requirements
      Courses of Action Assessment?
      Mix?
      Effectiveness?
      Resource Planning
   c. Combat Development
      Current or New Doctrine? To be developed
      Competing Strategies? To be developed
      Policy Study? To be developed

2. Operation Support Tool (Decision Aid)
   a. Skills Development
      Team? Yes
      Individual? Yes
   b. Exercise Driver
      Field Training Exercise Driver? No
      Command Post Exercise Driver? Yes
      Individual Exercise Driver? No

DESCRIPTION:
Domain: Land.

Span: Regional.

Environment: Day or night all weather.

Force Composition: Joint and combined forces (Blue and Red).

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions using conventional weapons.

Level of Detail of Process and Entities:
Entity: Brigade up to Corp.
Process: Attrition, generation of casualties (battle and non battle), movement, consumption of all classes of supply, repair and recovery, resupply, casualty treatment and evacuation, ammunition and fuel usage.

CONSTRUCTION:
Human Participation:
(1) Required:
(a) For Decisions? Yes
(b) For Process? No
(c) For Both?
(2) Not Required:
(a) Interruptable?
(b) Scheduled Changes?
(c) Not permitted?

Time Processing:
(1) Dynamic:
(a) Time Step? Yes
(b) Event Step? Yes
(c) Closed Form?
(2) Static:

Treatment of Randomness:
(1) Stochastic:
(a) Direct Computation? Yes
(b) Monte Carlo? No
(2) Deterministic:
(a) Generate a value as a function of an expected value?
(b) Basically Deterministic (No randomness)?

Sidedness:
(1) One-sided?
(2) Two-sided:
(a) Symmetric?
(b) Asymmetric
One side non-reactive?
Both sides reactive? Yes
(3) Greater than two-sided:
(a) Symmetric?
(b) Asymmetric
One or more side non-reactive?
All sides reactive?

LIMITATIONS: Simulation of naval and air effects, limited to direct effects on land battle. Resolution in simulating low level conflicts.

PLANNED IMPROVEMENTS/MODIFICATIONS: Provision of video map representaticn. Enhanced screen presentation. More stations, improved LANs, multi-processing, analytical capability.

INPUT: Scenario, weapon characteristics, operation orders/plans, administration orders/plans, road networks, consumption rates. Logistic functional characteristics.

OUTPUT: Printed reports detailing unit status, staff tables, logistic reports and returns.

HARDWARE AND SOFTWARE:
Computer (OS): IBM PC AT MS DOS 3.2; VAX VMS.
Storage: Not assessed for VAX.
Peripherals: Printers and a plotter.
Programming Language: Pascal.
Documentation: Draft.

SECURITY CLASSIFICATION: Restricted.

GENERAL DATA:
Data Base: Unknown at this stage.

CPU Time Per Cycle: Not applicable.

Data Output Analysis: Not applicable.

Frequency of Uses: Expected 2 times per year (initially).

Users: Command and Staff College, Command Headquarters.

Comments: Release date 2nd quarter 1990. Provides both real and accelerated time play.

TITLE: Optimum Supply and Maintenance Model (OSAMM)

DATE IMPLEMENTED: Original release - 1983; release 2.0 - 1987.

MODEL TYPE: Analysis.

PROPONENT: HQ CECOM, Attn: AMSEL-PL-SA, Fort Monmouth, NJ 07703-5004

POINT OF CONTACT: Owen Robatino, AV 992-4381/(201) 532-5170.

PURPOSE: The OSAMM can be used as a Research & Evaluation Tool for Logistic Support Analysis (LSA). It performs Level of Repair Analysis (LORA) on new and existing equipment. This includes weapon systems as well as support equipment. The OSAMM can deal with a system's development by determining the impact of system design on logistics support.

It should be noted that the OSAMM can be used during any phase of a system's life. It can be used to determine the maintenance concept of an equipment prior to fielding or to reconsider the maintenance concept of an equipment after fielding. It determines the most cost effective maintenance concept and initial spares placement for an equipment, subject to an availability requirement.

DESCRIPTION:

Domain: Land.

Span: Global.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities:

Entities: Line Replaceable Units (LRUs) and Shop Replaceable Units (SRUs) within an equipment. Test equipments and repairmen used to repair the equipment. Maintenance and supply echelons for the equipment.

Processes: Repair of end item, LRUs, and SRUs. Supply of LRUs, SRUs, and piece parts.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Deterministic, generating values as a function of expected values.

Sidedness: N/A.

LIMITATIONS: OSAMM is not a Wargaming or Simulation model.

PLANNED IMPROVEMENTS/MODIFICATIONS: Being determined by U.S. Army Materiel Command, Materiel Readiness Support Activity (MRSA).

INPUT: LRU/SRU breakdown, logistic structure, Reliability and Maintainability (RAM) data, inventory cost parameters, Order-Ship Times (OSTs), Turnaround Times (TATs), operational availability target.

OUTPUTS: Repair level decisions, spares requirements, test equipment and repairmen requirements, costs, operational availability.

HARDWARE AND SOFTWARE:
Computer: Control Data Corp (CDC) Network Operating System (NOS).
Storage: Unknown.
Peripherals: Terminal, line printer.
Programming Language: FORTRAN .
Documentation: OSAMM Release 2.0 User's Guide - DTIC AD A187675; OSAMM Technical Documentation - DTIC AD B115385.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: Depends on the user's knowledge of LSA, OSAMM and the equipment being modeled.

CPU Time per Cycle: Depends on the complexity of the equipment being modeled.

Data Output Analysis: Depends on the user's knowledge of OSAMM.

Frequency of Use: Varies by activity, but is used at least several times per year by those listed below.

Users: CECOM, AMCCOM, AMSAA, MRSA.

Comments: OSAMM uses algorithms of the Selected Essential-Item Stockage for Availability Method (SESAME) model, which is the standard Army model for calculating initial sparing quantities subject to an availability requirement.

DATE IMPLEMENTED: 11/01/89

TITLE: PANTHER

MODEL TYPE: Training and Education

PROPONENT: U.S. Army Combined Arms Command - Training, ATTN: ATZL-CTS Ft. Leavenworth, KS 66027

POINT OF CONTACT: MAJ de la Pena, MAJ Velez, CPT Koone AV 552-3189/3395 ATTN: ATZL-CTS-BB, U.S. Army Combined Arms Command - Training

PURPOSE: Training and Education. Panther is used to train commanders and staffs on staff coordination in a Low-Intensity Conflict (LIC) environment.

DESCRIPTION:
Domain: Land, air and rivers.
Span: Local, tactical level.
Environment: Any terrain, weather, time or day.
Force Composition: Joint, combined at tactical level.
Scope of Conclict: LIC.
Mission Area: Panther focuses on the non-lethal aspects of LIC but also models direct and indirect fire, TACAIR, aviation and air defense.
Level of Detail of Processes and Entities: Panther models down to individual soldier, individual aircraft or piece of equipment. In a combat engagement, model will deplete units by equipment, munitions and personnel (WIA, KIA, MIA; if wounded in action describes wounds). Model processes all civil affairs, PSYOPS, combat actions by zones. This provides the basis for changes in popular support of the legitimate government forces.
Human Participation: Required, waits for decisions.
Time Processing: Dynamic.
Treatment of Randomness: Stochastic; Monte Carlo.
Sidedness: Two-sided, asymmetrical.

LIMITATIONS: Boardgame requires maps blown up to 1:6, 250 and 12,500 scale. Controllers determine CA/PSOPS activities. Requires about 1 day to install data base.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Write program in Spanish. Write Battle Board Worksheet in such a way that one worksheet produces one output. Modify software to make system more user friendly.

INPUT:
Scenario, OPORD, order of battle.

OUTPUT:
Computer printouts.

HARDWARE AND SOFTWARE:

COMPUTER (OS): IBM XT/AT MS DOS

STORAGE: 10 MB

PERIPHERALS: High Speed Printer

PROGRAMMING LANGUAGE: Turbo Pascal 5.5.

DOCUMENTATION: Basic Rules, How to Train Manual and Technical Guide.

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 1 day.

CPU TIME PER CYCLE: Unknown

DATA OUTPUT ANALYSIS: N/A

FREQUENCY OF USE: As often as desired.

USERS: U.S. Army tactical units, Latin American CGSC and AOC equivalent schools.

TITLE: PROCA DATE IMPLEMENTED: 1989-90.

MODEL TYPE: Analysis, possibly Training & Education.

PROPONENT: Operational Research and Analysis Establishment, Directorate of Land Operational Research.

POINT OF CONTACT: Daniel U. Thibault, (613) 995-8080.

PURPOSE: Analysis role: Weapon Systems Effectiveness Research & Evaluation Tool Training & Education role: Seminar Exercise Driver Proca is designed to integrate detailed minefield breaching assessment into the Janus computer wargame. It is a controller tool, the Janus-Proca interface being entirely human. Proca supplies an accurate simulation of the minefield breaching per se, while Janus supplies the accurate simulation of the simultaneous direct and indirect fire battle. Although not designed to run alone, Proca could become the core of a full scale stand alone minefield breaching training simulation; interest has already been expressed by developers for that particular purpose.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: Minefield only. Proca can handle several minefields at once, each having its own reference frame. Ground relief and features are not modelled.

Force Composition: Breaching column blue or red.

Scope of Conflict: Mines and Countermeasures only.

Mission Area: Minefield breaching only.

Level of Detail of Processes and Entities:

Entities: Tank sub-parts, countermeasure sub-parts, individual mines.

Processes: Explosive Breaching, Mechanical Breaching, Detection, Scatterable Mine Delivery All processes are time-independent transformations except for Mechanical Breaching. In the latter, a described breaching column of vehicles encounters mines in its path in time sequence until the breach is completed or a vehicle suffers a casualty.

CONSTRUCTION:

Human Participation: Required for Decisions (The simulation stops until the player inputs a new command).

Time Processing: Mechanical Breaching is dynamic, event-driven; all other processes are "instantaneous" data base transformations.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, Asymmetric, Both Reactive. The defending player can only react with the addition of Scatterable Mines in between breaching player actions.

LIMITATIONS: This software package was designed as a controller-level "patch" of Janus 4.05. It could also be used as a stand alone minefield breaching simulator but would then be somewhat awkward in its interface.

PLANNED IMPROVEMENTS/MODIFICATIONS: Plans for its integration into a full-blown minefield breaching simulator are being discussed. It might also serve as a basis for a new Janus minefield module. Finally, there is a remote possibility of it being developed into a batch processor for minefield, countermeasure, and tactic effectiveness assessment.

INPUT: Mine, Countermeasure, and Vehicle engineering characteristics. Minefields are laid out using a companion software. The user interface is textual, menu-driven.

OUTPUT: Printout of event log, detailing each event and its outcome.

HARDWARE AND SOFTWARE:
Computer: VAX/VMS.
Storage: About 300k of source code. 64k of executables. Master data file around 10k, most minefields data files are in the 10 to 20k range.
Peripherals: One VT100 terminal required. Printer currently hardwired into the code.
Programming Language: Pascal.
Documentation: DLOR Staff Notes 90/1, 90/2, and 90/10.

SECURITY CLASSIFICATION: UNCLASSIFIED, but data base may be classified.

GENERAL DATA:
Data Base: Depends on accessibility.

CPU Time per Cycle: Very little; simulation is interactive.

Data Output Analysis: Inserted into Janus event log.

Frequency of Use: Iron Dragon wargame series.

Users: DLOR. Interest has been expressed by various other Janus users (USA, UK, Australia).

TITLE: Small Force Weapons and Tactics Evaluation Model - SWATEM

DATE IMPLEMENTED: 1987.

PROPONENT: U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD 21005-5066.

POINT OF CONTACT: Dr. Joseph Wald, DSN 298-9077/(301)278-9077.

PURPOSE: SWATEM is a heterogeneous, few-on-few model that simulates a battle between two small groups of opposing forces. The characteristics of the weapons (including both hardware and tactics) are defined by user. While SWATEM was designed to investigate conflicts between air defense systems and hovering helicopters, full participation on both sides of armored vehicles and hovering helicopters is possible.

DESCRIPTION:

Domain: Land and air.

Span: Local battle.

Environment: Terrain to mask helicopters and defilade ground vehicles.

Force Composition: Any small mix of hovering helicopters and ground vehicles.

Scope of Conflict: Conventional.

Mission Area: Ground battle and air defense.

Level of Detail of Processes and Entities: SWATEM simulates a battle between two small groups of opposing forces. Each side may have up to 10 individual "game pieces" partitioned into at most 4 distinct "weapon classes". The definition of a weapon class includes not only a physical description of the weapon and its capabilities, but also a description of the tactics that the weapon will employ during the battle. In this context, the term "tactics" includes such features as exposure time; disengagement criteria; weapon selection; under what conditions to close with the enemy, hold one's position, or retreat; and the many situations in which a decision to remask (temporarily) must be made.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Event step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: No movement of systems while unmasked.

PLANNED IMPROVEMENTS AND MODIFICATIONS: SWATEM will be replaced by a new model which will have the same general structure as SWATEM, but will have many enhancements, both in weapon class design flexibility and in the modeling of tactics. The new model will be less slanted toward air defense with more detail in the modeling of the ground battle.

INPUT: For each system, a complete physical description and tactical profile. The type and amount of data required will vary greatly, depending upon the types of systems to be modeled.

OUTPUT: Damage inflicted by each side, ordnance expenditure statistics, event processing histories, graphics - battlefield "snapshots".

HARDWARE AND SOFTWARE:
Computer: CRAY X-MP, CRAY II.
Storage: Approximately 500,000 words on a CRAY II are sufficient to load and run the program.
Peripherals: Input device, printer, graphics.
Programming Language: FORTRAN 77.
Documentation: AMSAA TR 437, The Small-Force Weapons and TActics Evaluation Model (SWATEM), March 1988 AD B12142. BRL-TR03060, SWATEM: Input Guide, December, 1989.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Data Base: A few hrs to a week.

CPU Time per Cycle: A few seconds to 30 minutes for 100 MC replications on CRAY X-MP.

Data Output Analysis: A few minutes to an hour.

DATE IMPLEMENTED: 09/01/80

TITLE: Tactical Simulator (TACSIM)

MODEL TYPE: Training and Education.

PROPONENT: Joint Tactical Fusion Program Management Office (JTFPMO), Mclean, VA. TRADOC Proponent: CAC-T, Ft Leavenworth, KS

POINT OF CONTACT: Edward N. Sowell, HQ TEXCOM ATTN: ATCT-BA-SDM, FT Hood TX 76544 AV 738-9517; TRADOC POC: MAJ Marion, AV 552-3180, ATZL-CTS

PURPOSE: To provide an interactive computer-based simulation to support intelligence and electronic warfare (IEW) system development and testing; command post training exercises (CPX); and evaluations of IEW and command, control and communications (C3) functions. It supports decisions, corps and echelons above corps (EAC) systems evaluation, training and the all-source analysis system/enemy situation correlation element (ASAS/ENSCE) program development.

DESCRIPTION:
Domain: Land and air.
Span: Local.
Force Composition: OPFOR equipment signatures detectable by sensors.
Scope of Conflict: Conventional war.
Mission Areas: Intelligence.

CONSTRUCTION:
Human Participation: Human participation required for decisions and processes.
Time Processing: Dynamic, event stepped.
Treatment of Randomness: Stochastic, Monte Carlo.
Sidedness: Two-sided, asymmetric.

LIMITATIONS: The resolution of the sensor modeling is not sufficient for sensor trade-off studies.

INPUT:
- OPFOR unit observables, their strengths and deployment.
- OPFOR unit locations and preplanned movement.
- Operational characteristics of the sensors and tasking.
- Operational environment and exercise controllers.

OUTPUT:
The primary output of TACSIM is intelligence reports in standardized format. These reports are of the quality and quantity expected of the communications, electronic and imagery sensors available to a U.S. commander in wartime. Special reports are also provided to assist simulator operators and exercise controllers.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX 11/785, VAX 8250 or VAX 8600. VMS

STORAGE: 16MB internal memory; 4 disk drives with at least 200 MB each

PERIPHERALS: 3 CRTs and one printer.

PROGRAMMING LANGUAGE: FORTRAN, SALSIM (FORTRAN version of SIMSCRIPT)

DOCUMENTATION: TACSIM User's Manual for Liaison Officers and Exercise Controllers; TACSIM Software Description, Vol I-III; TACSIM Operators Manual, Vol I-III; Software User/Operator Manuals (6).

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 3 months

CPU TIME PER CYCLE: Unknown

DATA OUTPUT ANALYSIS: N/A

FREQUENCY OF USE: Supports training of division and corps CPXs.

COMMENTS: TACSIM is normally run at the sensitive compartmented information (SCI) level of classification which limits its use to SCI facilities.

TITLE: TACWAR

DEVELOPER: IDA

USER: LA2

PURPOSE: To assess theatre level ground combat between NATO and WP forces, to provide a model for assessing various tactics and unit dispersion philosophies in a NBC environment, and to assess the contributions and interactions of division sized combat units, along with the impact of tactical air units and nuclear and chemical weapons, on the outcome of the theatre war.

GENERAL DESCRIPTION: TACWAR is a deterministic simulation of battle at Theatre level. It comprises five main submodels - ground combat model, air combat model, target acquisition model, nuclear model and chemical model. There are also modules to update force status and to model resupply. The air and ground combat models operate on a fixed 12-hour cycle while the TA, nuclear and chemical models have a variable cycle length of 12-hours or less. Supplies are updated every 72-96 hours. Terrain is modelled as a series of sectors, subdivided into battle areas as in the LACM (q.v.). However, unlike the LACM, forces can move into adjacent sectors. Forces are aggregated into combat divisions, subdivided into company sized units for nuclear and chemical targetting. The numbers of personnel and weapons in each unit and subunit are recorded. Separate account is kept of chemical and nuclear systems. The air model represents all aspects of the air campaign, including close air support, interdiction, counter air, air defence, escort, defence suppression and recce sorties. Forward airbases are located within battle areas and may be overrun, or attacked by nuclear or chemical weapons. A communications zone is played for each side, and as well as containing rear airbases, provides for combat units, tactical aircraft, supplies and replacement weapons and personnel arriving in theatre. The target acquisition model represents fixed and mobile stand-off sensors and penetrating sensors, which may be associated with divisions or with geographical areas. Data is held on civilian population densities.

COMPUTER STATUS: Available on VAX

DOCUMENTATION: WSEG Report 275 - Vol I General Description: Vol II detailed description. DOAE Library Acc No 57411/2.

COMMENT: TACWAR has not yet been used in a DOAE Study. It requires a large database, and DOAE has an unclassified test version.

TITLE: Target Acquisition Fire Support Model - TAFSM

DATE IMPLEMENTED: Circa 1983.

MODEL TYPE: Analysis.

PROPONENT: U. S. Army Field Artillery School, Fort Sill, OK 73503-5600, U. S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD 21005-5071 .

POINT OF CONTACT: U. S. Army Materiel Systems Analysis Activity Attn: AMXSY-GS (L. Blankenbiller), Aberdeen Proving Ground, MD 21005-5071, DSN 298-5047/(301) 278-5047.

PURPOSE: TAFSM is a damage assessment/weapons effectiveness model used primarily as a Research and Evaluation Tool. It is designed to evaluate competing artillery force structures and operational concepts as well as the effects of weapon systems against various target types.

DESCRIPTION:

Domain: Land and air.

Span: European theater; division sized.

Environment: Statistical terrain is used; database reflects terrain interactions (line-of-sight), open/woods environment, time of day (day/night).

Force Composition: Combined forces, Blue and Red.

Scope of Conflict: Conventional weapons.

Mission Area: Primarily indirect fire artillery with modular direct fire ground game.

Level of Detail of Processes and Entities: Unit resolution is a function of range from the FLOT anduser-directed inputs. Maneuver units are usually at platoon level; fire units at platoon or section level. Movement, target acquisition, communications and mission processing activities are explicitly played at the lowest level defined by the user. Damage is assessed against each individual target element. Attributes for weapon systems, ammunition types, fire direction centers and sensors define the systems' capabilities and performance measures used by subroutines which model the systems' operational functions.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Event sequenced, time stepped using dynamic 24/48 hour scenario.

Treatment of Randomness: Indirect fire kills are assessed stochastically, with Monte Carlo determination of result. The direct fire ground game uses a stochastic Lanchester attrition model.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Fixed movement paths, dirty battlefield not played explicitly, Red artillery decision rules same as Blue, large threat data scenario requirements, extensive scenario development effort required.

PLANNED IMPROVEMENTS/MODIFICATIONS: Updated scenario. Refined direct fire ground game. Joint task force missions added.

INPUT: Unit locations and movement schedules. Weapon system and sensor characteristics. Munition characteristics. Communications network. Force structure.

OUTPUT: Tabular data: measures of effectiveness - no. systems destroyed, no. of personnel killed, force attrition; measures of performance- fire missions requested/fired, sensor reports, ammunition expenditures, effects per round type and target element, tube failures and attrition, other items from fire direction centers, communications system and resupply.

HARDWARE AND SOFTWARE:
Computer: Digital VAX/VMS 11/785.
Storage: 220K Bytes.
Peripherals: Line printer, magnetic disks and/or tape drives.
Programming Language: FORTRAN 77 dialect XFOR.
Documentation: User and programmer manual. Draft documentation for the direct fire ground game module.

SECURITY CLASSIFICATION: UNCLASSIFIED without database and/or scenario.

GENERAL DATA:
Data Base: Time to make database updates and set up inputs might run as much as two to four weeks.

CPU time per Cycle: Approximately 8-10 hours with minimum acceptable replications and a 24 hour scenario.

Data Output Analysis: Typically a week or more is required.

Frequency of Use: Varies extensively by organization, but is used at least several times per year.

Users: Directorate of Combat Developments, U. S. Army Field Artillery School and Ground Warfare Division, U. S. Army Materiel Systems Analysis Activity.

Comments: None.

RELEASABILITY: Program code is releasable. Some input data are classified SECRET NOFORN and therefore not releasable.

TITLE: TERRA AUSTRALIS DATE IMPLEMENTED: 1985.

MODEL TYPE: Training and Education.

PROPONENT: Australian Army War Game Centre.

POINT OF CONTACT: Project Leader AWGC 62-2-9604411.

PURPOSE:
Analytical:

1. Research & Evaluation
   a. Weapons Systems
      Systems Development?
      Systems Effectiveness?
   b. Force Capability and Requirements
      Courses of Action Assessment?
      Mix?
      Effectiveness?
      Resource Planning
   c. Combat Development
      Current or New Doctrine?
      Competing Strategies?
      Policy Study?

2. Operation Support Tool (Decision Aid)
   a. Skills Development
      Team? Yes
      Individual? No
   b. Exercise Driver
      Field Training Exercise Driver? No
      Command Post Exercise Driver? Yes
      Individual Exercise Driver? No

DESCRIPTION:
Domain: Land.

Span: Theatre.

Environment: Day or night. All weather.

Force Composition: Joint and combined forces. (Red and Blue).

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions.

Level of Detail of Process and Entities:
Entity: Brigade to Corp.
Process: Attrition of personnel and equipment, generation of casualties (both battle and non battle), consumption of classes 1, 3, 5 and others, repair and recovery, resupply, casualty treatment and evacuation, transport and movement.

CONSTRUCTION:
Human Participation:
(1) Required:
(a) For Decisions? Yes
(b) For Process? No
(c) For Both?
(2) Not Required:
(a) Interruptable?
(b) Scheduled Changes?
(c) Not permitted?

Time Processing:
(1) Dynamic:
(a) Time Step? Yes. 24 hour game turn to 6 hours real time.
(b) Event Step?
(c) Closed Form?
(2) Static:

Treatment of Randomness:
(1) Stochastic:
(a) Direct Computation? Yes
(b) Monte Carlo? No
(2) Deterministic:
(a) Generate a value as a function of an expected value?
(b) Basically Deterministic (No randomness)?

Sidedness:
(1) One-sided?
(2) Two-sided:
(a) Symmetric?
(b) Asymmetric
One side non-reactive?
Both sides reactive? Yes
(3) Greater than two-sided:
(a) Symmetric?
(b) Asymmetric
One or more side non-reactive?
All sides reactive?

LIMITATIONS: Only limited Naval and Air effects are modelled.

PLANNED IMPROVEMENTS/MODIFICATIONS: Planned replacement by OPALS.

INPUT: Weapons, attrition tables, characteristics of units, road networks, consumption tables, Logistic functional characteristics.

OUTPUT: Printed reports of staff tables, attrition logistics holdings.

HARDWARE AND SOFTWARE:
Computer (OS): IBM PC/AT with PC Network;MS DOS 3.2.
Storage: 8Mb disk for total system. 1.5Mb per station.
Peripherals: 132 column printers.
Programming Language: UCSD (PASCAL).
Documentation: Draft.

SECURITY CLASSIFICATION: Restricted.

GENERAL DATA:
Data Base: 2 weeks.

CPU Time Per Cycle: Not applicable.

Data Output Analysis: None.

Frequency of Uses: 1 per year.

Users: Command and General Staff Course.

TITLE: Test Program Set Cost Effectiveness Evaluation
Model - TPS CEEM

MODEL TYPE: Analysis.

PROPONENT: HQ CECOM, Attn: AMSEL-PL-SA, Fort Monmouth, NJ 07703-5000

POINT OF CONTACT: Owen Robatino, AV 992-4381/(201) 532-3646.

PURPOSE: TPS CEEM is used as a research & evaluation tool for determining the economic feasibility of utilizing TPSs for the maintenance of circuit card assemblies (CCAs).

DESCRIPTION:

Domain: Land.

Span: Global.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities:

Entities: Line Replaceable Units (LRUs) and Shop Replaceable Units (SRUs) within an equipment. Test equipments and repairmen used to repair the equipment. Maintenance and supply echelons for the equipment.

Processes: The model evaluates six maintenance alternatives, three of which involve the development and usage of a TPS. The model estimates the nonrecurring costs of TPS development, documentation, and Interconnecting Devices (ICDs); TPS maintenance costs over the end item life; and other applicable costs.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Deterministic; generates values as a function of expected value process.

Sidedness: N/A.

LIMITATION: User's manual has not been developed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: A user's manual will be developed.

INPUT:

End Item Input File: Data unique to the end item under consideration and data on each CCA including cost of TPS development. This file is created by the user.

Factors Input File: Logistics and cost factors such as support costs and percentages as well as times associated with maintenance and supply. Default values for this file are under development. The user can modify and default values to suit the end item under consideration.

OUTPUT:

Listing of input data.

Table of estimated costs of each maintenance alternatives for each CCA with an indicator highlighting the lowest cost alternative.

CCA rank ordered based on estimated TPS costs effectiveness.

CCA rank ordered based on highest expected failures over life cycle.

HARDWARE AND SOFTWARE:

Computer: PC Compatible.

Storage: 100K bytes for executable code.

Peripherals: Monitor, printer.

Programming Language: FORTRAN 77

Documentation: Test Program Set Cost Effectiveness Evaluation Model (TPS CEEM) General Description, Jan 1988, USA CECOM, P&O Directorate, Systems Analysis Division.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:

Data Base: N/A.

CPU Time per Cycle: Depends on the number of CCA's being analyzed.

Frequency of Use: Has been used on four CECOM programs and it will be used on many more CECOM programs.

Users: Joint STARS, SINCGARS, AN/TMQ-31 and DGM programs.

Comments: The model is structured to allow the user to interactively perform sensitivity analysis on five factors.

Releasability: Releasable to U.S. Government only.

TITLE TEWTORIAL DATE IMPLEMENTED: 1982.

MODEL TYPE: Analysis.

PROPONENT: BGWG Section, CA4 Division, RARDE, Fort Halstead, Kent, England, U.K.

POINT OF CONTACT: I. S. Gardner, CA4, RARDE, Fort Halstead, Kent, U.K., 0959-32222, ext 2444.

PURPOSE: The game is a research and evaluation tool, dealing primarily with weapon systems development and effectiveness. It can also be used to assess force capability and requirements, dealing with courses of action, mix, and effectiveness.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: A 1:20,000 map.

Force Composition: Up to Regimental level.

Scope of Conflict: Conventional.

Mission Area: Any conventional missions within the domain.

Level of Detail of Processes and Entities: The lowest entities modelled are fire teams and individual vehicles, though most units are of platoon size. Attrition, movement and target acquisition are modelled for each entity.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Processing is dynamic, the model uses time stepping.

Treatment of Randomness: The model is stochastic, it uses the Monte Carlo method.

Sidedness: The model is two-sided and symmetric.

LIMITATIONS: Does not model C3I, close combat and air/ground interactions are not modelled adequately. The model is only detailed enough to investigate gross changes in weapon systems, force composition, etc..

PLANNED IMPROVEMENTS/MODIFICATIONS: None.

INPUT: System and weapon characteristics including attrition data, mobility data and activity timings.

OUTPUT: Records of all direct fire and indirect fire events and mine encounters are recorded manually.

HARDWARE AND SOFTWARE:
Computer: None.
Storage: None.
Peripherals: None.
Programming Language: None.
Documentation: There is a set of rules and data tables.

SECURITY CLASSIFICATION: UNCLASSIFIED, data classified SECRET.

GENERAL DATA:
Data Base: About 3 man months per study.

CPU Time per Cycle: None.

Data Output Analysis: Manual.

Frequency of Use: No longer in regular use.

Users: BGWG section, CA4 Division in response to requests for studies by a series sponsor from within the MOD.

Comments: There are at least two other versions of this model in the U.K.

TITLE: TOW Missile System Simulations DATE IMPLEMENTED: 1978.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity.

POINT OF CONTACT: Director, USAMSAA, ATTN: AMXSY-CS (MR. A. GORDON), Aberdeen Proving Ground, MD 21005-5071 AV 298-6459/(301) 278-6459.

PURPOSE: A set of research and evaluation tools used during system development and to provide item level performance input to force-on-force models. The TOW Missile Systems Simulations are computerized, analytical models that simulate the in-flight performance of the family of TOW Missile Systems. These simulations are used primarily to compute the accuracy of the TOW Missile Systems using gunner aiming error and target motions as input.

DESCRIPTION: The TOW simulations include 6 degree-of-freedom equations of motion, mathematical models of the guidance equations and uncertainties associated with certain parameters.

Domain: Land, air.

Span: Individual.

Environment: None.

Force Composition: Element.

Scope of Conflict: Any involving guided anti-armor weapons.

Mission Area: Anti-armor.

Level of Detail of Processes and Entities:
Entity: Individual weapon and its mount.
Processes: Probability of hit.

CONSTRUCTION:
Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: One-on-one, no obscuration.

PLANNED IMPROVEMENTS/MODIFICATIONS: Effort is underway to recode all basic TOW simulations in a Universal TOW Simulation model, and to develop a family of TOW IIB models.

INPUT: Gunner Aiming Error; Target Velocity.

OUTPUT: User selectable including means and standard deviations of the missile's position as a function of time.

HARDWARE AND SOFTWARE:
Computer (OS): Cray XMP (UNIX).
Storage required: 32K.
Peripherals: None.
Programming Language: FORTRAN.
Documentation: AMSAA TR 293, "Simulation and Analysis of the Training Effectiveness Analysis-TOW (TEA-TOW) Flight Data," Patrick E. Corcoran, April 1980.

SECURITY CLASSIFICATION: (Model without data) UNCLASSIFIED.

GENERAL DATA:
Database: Available from tests and separate models; about one week depending on scope.

CPU Time per Cycle: 5 seconds.

Data Output Analysis: A few hours.

DATE IMPLEMENTED: 01/01/82

TITLE: Transportation and Supply Activities (TRANSACT)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command, Ft Lee (TRAC-LEE)
Fort Lee, VA 23801

POINT OF CONTACT: Bruce E. Lasswell, AV 687-1050, Fort Lee, VA 23801

PURPOSE: To furnish information on how supply requests may be satisfied under constraints of load/unload capability, vehicle availability, terminal/dock availability, network and enemy attack.

DESCRIPTION: TRANSACT is a physical distribution model created using the MAWLOGS Modeling System. It can be run either stochastically or deterministically. Unit requests are levied on a supply system which assigns loading assets and vehicles to ships request over a detailed network. Vehicles may be attacked when halted. The terminals, supply points, and network may also be attacked.

CONSTRUCTION:
Human Participation: Not required--scheduled changes.
Time Processing: Dynamic, event-step.
Treatment of Randomness: Either stochastic, Monte Carlo or basically deterministic as required by the user.
Sidedness: One-sided.

LIMITATIONS: Data set can be extensive. Not directly related to combat models.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Weight and cube of items to be moved, supply support structure and stockage parameters/policy, transportation network description, supply request schedule, vehicle characteristics and location, scenario such as location and priority of units, and attack schedule.

OUTPUT: Weight and cube of cargo delivered (also number of items by item), items requested, network and vehicle overloads, average and peak workloads for each link/terminal, queue buildups for each link/terminal, supply point workloads and supply status by node/class/item, dock and vehicle utilization, BOH at supply units over time, vehicle production in terms of weight and distance, attack results.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX 11/780, SUN 4/280.

STORAGE: Variable.

PERIPHERALS: Printer and tape drive.

PROGRAMMING LANGUAGE: FORTRAN 77.

DOCUMENTATION: Users' Guide for LOGATAK II (DLSIE 42543-MC), Programers' Guide for LOGATAK II.

OTHER COMMENTS: TRANSACT was created using the Models of the Army

Worldwide Logistics System (MAWLOGS).

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: N/A.

CPU TIME PER CYCLE: Varies.

DATA OUTPUT ANALYSIS: One to three weeks.

FREQUENCY OF USE: As needed.

USERS: Proponent and U.S. Army Transportation School.

COMMENTS: Government agencies can obtain TRANSACT with a signed memorandum of agreement. Government contractors with a valid contract requiring the use of TRANSACT can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or call Av 552-5511 or commercial 913-684-5511.

TITLE: Transportation Model - TRANSMO   Date Implemented: 1979.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, Attn: Mobilization and Deployment Directorate, 8120 Woodmont Avenue Bethesda, MD 20814-2797.

POINT OF CONTACT: Ms. Vera W. Hayes, (301) 295-1137/AV 295-1137.

PURPOSE: TRANSMO is used primarily to analyze strategic deployment issues taken in the context of the Defense Guidance Illustrative Planning Scenario. It specifically simulates the loading of cargo on inter-theater lift vehicles, ultimately resulting in an arrival sequence of cargo in the theater(s) of operation.

DESCRIPTION:

Domain: Sea and air.

Span: Accommodates any theater or theaters depending on data base input.

Environment: Availabilities, loading and unloading time of inter-theater lift assets are represented in terms of hundredths of an hour. Port throughput capacities are represented by numbers of lift assets that can be handled at any given time during the simulation.

Force Composition: Movement requirements represent all services, with particular emphasis on Army requirements (data base dependent).

Scope of Conflict: Generally conventional with capability to represent chemical degradation of ports.

Mission Area: Generally represents sea and airlift requirements.

Level of Detail of Processes and Entities: Processes on an hourly basis for aircraft and a daily basis for sealift. Lift assets are represented by their speed and capacity--short tons for airlift and short tons, square feet, and measurements tons for sealift. Movement requirements, which represent a varied level of detail from a division to a UIC or an aggregation of resupply or ammunition requirements, are displayed by their characteristics (bulk, over, outsize cargo for air requirements and short tons, square feet, and measurement tons for sealift requirements). Attrition is based on an expected value; if sea or air assets are in the zone of hazard during the period in which attrition is begin applied, each vessel will be attrited by the expected attrition value in effect. TRANSMO can be viewed as a model with a flexible level of detail ranging from low to high levels of resolution depending upon the input data.

CONSTRUCTION:

Human Participation: None required; relies on scheduled changes.

Time Processing: Dynamic, time and event step.

Treatment of Randomness: Sea and air attrition are deterministically determined based on expected value during a time period.

Sidedness: One-sided.

LIMITATIONS: No specific limitations.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT:

- Scenario data include
  - lift asset availability at POEs
  - asset capacities
  - load and unload times
  - distances between ports
  - pre-determined attrition rates
- Movement requirements include
  - availability at the POE
  - latest arrival date at the POD
  - unit of measurements expressed in terms of short tons, square feet, and measurement tons

OUTPUT: Depends on the level of detail and quality of the input. Produces printouts of movement requirements; attrition associated with each requirement, and arrival time at the POD. Many other analyst reports are available for review to determine how the deployment was conducted.

HARDWARE AND SOFTWARE:

Computer: Originally designed to run on the UNISYS 1100/84. Primarily executed on the VAX 8600 with VMS operation system.

Storage: 80,000 blocks (40 MB) for the model only.

Peripherals: Minimum requirements: one printer, one VT100 terminal, and one 400K block hard disk.

Language: FORTRAN 77.

Documentation: User manual with two appendixes.

SECURITY CLASSIFICATION: Unclassified, but data bases are generally classified.

GENERAL DATA:

Date Base: Full scenario development and generation of movements requirements require approximately two man-months of effort.

CPU Time Per Cycle: Scenario dependent, but normally under 30 minutes.

Data Output Analysis: Post-processor aids in analysis of outputs. Analysis is generally completed within three weeks after the first output is produced.

Frequency of Use: In constant use to support USACAA studies. The model is run more than 100 times per year.

Users: USACAA.

Comments: Managed by the USACAA to support all strategic deployment studies supporting larger efforts (OMNIBUS, SRA, PFCA, SCAN, and MRFS) changes to the model are made as necessary to support model improvement or when analytical needs dictate.

DATE IMPLEMENTED: 01/01/82

TITLE: Transportation Network Attack Model (TRANATAK)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command, Ft Lee (TRAC-LEE)

POINT OF CONTACT: Bruce E. Lasswell, AV 687-1050, Ft Lee, VA 23801

PURPOSE: To furnish information on how transportation requests may be satisfied under constraints of load/unload capability, vehical capability and availability, terminal/dock availability, network and enemy attack.

DESCRIPTION: This is a transportation-only derivative model of the MAWLOGS modeling system. The model responds to scheduled (push) shipments over a explicit network using discrete vehicles. Vehicles are loaded by weight and cube. Only when halted may vehicles be attacked.

CONSTRUCTION:
Human Participation: Not required--scheduled changes.
Time Processing: Dynamic, event-step.
Treatment of Randomness: Either stochastic, Monte Carlo or basically deterministic as required by the user.
Sidedness: One-sided.

LIMITATIONS: Data set can be extensive. Not directly related to combat models.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Weight and cube of items to be moved, transportation network description (based on other model ouputs or SCORES scenario data), transportation request schedule, vehicle characteristics and locations, scenario such as location and priority of units, and attack schedule.

OUTPUT: Weight and cube of cargo delivered (also number of items by item), items requested, network and vehicle overloads, average and peak workloads for each link/terminal, queue buildups for each link/terminal, supply point workloads and supply status by node/class/item, dock and vehicle utilization, vehicle production in terms of weight and distance, at results.

HARDWARE AND SOFTWARE:

COMPUTER (OS): VAX 11/780, SUN 4/280.

STORAGE: Variable.

PERIPHERALS: Printer and tape drive.

PROGRAMMING LANGUAGE: FORTRAN 77.

DOCUMENTATION: User's Guide for LOGATAK II, (DLSIE 42543-MC), Programers' Guide for LOGATAK II.

OTHER COMMENTS: TRANATAK was created using the Models of the Army Worldwide Logistics System (MAWLOGS).

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: N/A.

CPU TIME PER CYCLE: Varies.

DATA OUTPUT ANALYSIS: Varies.

FREQUENCY OF USE: As needed.

USERS: Proponent and U.S. Army Combined Arms Support Command.

COMMENTS: Government agencies can obtain TRANATAK with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of TRANATAK can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or call AV 552-5511 or commercial 913-684-5511.

TITLE: TRASANA Aircraft Reliability and Maintainability Simulation - TARMS CAA Version II

DATE IMPLEMENTED: 1985. Original implementation 1978.

MODEL TYPE: Analysis.

PROPONENT: TRASANA, White Sands Missile Range, White Sands, New Mexico 88002-5502.

POINTS OF CONTACT: Mr. A. Gamble, (AV) 258-1901, Renee Carlucci, Chief, Modeling Team, U.S. Army CAA-FSC, (301) 295-5292.

PURPOSE: TARMS is designed to provide information on the operational availability of aviation elements of combat forces based on losses due to combat damage, system failures, and repair; and on return to combat based on times to repair, maintenance manpower, and parts supply.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates from company to theater depending on the database.

Environment: Cartesian plane; night and day operations, peace and war time.

Force Composition: Blue Aircraft, AVIM and AVUM level maintenance. Red, Anti-aircraft weapons.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: The blue aircraft are modeled individually against red anti-aircraft installations in the grid area that are performing various mission profiles including attack, contact, utility and recovery missions. All divisional units involved in operating and maintaining helicopter operations.

CONSTRUCTION:

Human Participation: Required for data formatting and database construction. Not required during simulation.

Time Processing: Event stepped model.

Treatment of Randomness: Air attrition stochastically based on direct computation of probability of detection and probability of kill.

Sidedness: Two-Sided, both sides reactive but asymmetric.

LIMITATIONS: Dependent on external data, and maintenance systems are not subject to attack.

INPUT: RAM data for systems of interest, combat damage over time, mission profiles over time, maintenance organizations,and ALDT for parts.

OUTPUT: Computer printouts containing charts of operational availability, parts required, system failures, and maintenance manpower requirements.

HARDWARE AND SOFTWARE:
Computer (OS): UNIVAC 1100, VAX 11/780.
Storage:46,000 Tracks. Changes depending on scenario used.
Peripherals: Printer.
Programming Language: SIMSCRIPT, FORTRAN.
Documentation: TRASANA Model Description Document and TRASANA Aircraft Reliability and Maintainability Simulation-CAA Version II User's Manual.

SECURITY CLASSIFICATION: UNCLASSIFIED.

GENERAL DATA:
Time Requirements: 24 weeks for preparation, run and analysis.

CPU Time per Cycle: Changes depending on size of scenario used. 2-20 hours.

Frequency of Use: Sporadic.

Users: DCSLOG, AVNC, CAA, Transportation School.

Releasability: Releasable.

Comments: Original version called TARMS was developed by RAIL Corporation for TRASANA in 1978 and was written in GPSS. TRASANA converted the model to SIMSCRIPT. In 1982, the model was transported from TRASANA to the US Army Concepts Analysis Agency (CAA) for use in support of the Maximizing Daily Helicopter Flying Hours (MAX FLY) Study. At that time, the portions of the model that represented combat damage inflicted by threat weapon systems underwent extensive modification to allow consideration of damage caused by missile systems with proximity-fused warheads. Upon completion of the MAX FLY Study, TARMS was further modified and expanded by CAA to its present form, TARMS-II. These modifications include:

- The capability to evaluate different repair parts acquisition policies (i.e., cross-leveling).

- Modification of doctrine relevant to attack/scout helicopter mixes for attack missions.

- The inclusion of an artificial intelligence package to allow selection of alternate flight profiles, or a decision not to fly specific missions based on experienced attrition rates.

- The inclusion of dynamic prescribed load list/authorized stockage list (PLL/ASL) modifications emulating the provisions of Army Regulation (AR) 710-2.

DATE IMPLEMENTED: 10/01/90

TITLE: Vector-in Commander (VIC)

MODEL TYPE: Analysis

PROPONENT: TRADOC Analysis Command (TRAC), Operations Analysis Center (OAC) Fort Leavenworth, Kansas 66027-5200

POINT OF CONTACT: Mr. Calkins, ATRC-FM, AV: 552-4595
TRAC-OAC, Fort Leavenworth, KS 66027-5200

PURPOSE: VIC is a computerized, analytical, mid-intensity model developed for use in estimating net assessments, performing force deployment studies, and generating information for performing trade-offs among weapon the outcome of force interactions is determined in terms of the ground gained or lost and the attritions of personnel and weapon systems.

DESCRIPTION: The VIC model is a two-sided, deterministic simulation of integrated land and air combat. The level of aggregation is the maneuver battalion or its equivalent. It employs forces up to the level of a U.S. corps facing an enemy of strength determined by scenario and theater in which the simulation takes place. VIC is an event-stepped model which also employs time steps for scheduling some actions. It uses modified differential equations for combat outcomes based upon the VECTOR-2 model. Tactical decisions and force employments are determined by tactical decision tables supplied by the user to provide flexibility in controlling model processes. Each side may employ maneuver unit weapon systems and weapons to tactical aircraft, as well as artillery, mines, helicopters, air defense systems, and other means of conducting combat at the U. S. Corps Level.

CONSTRUCTION: VIC is a two sided model requiring no human participation once the data bases are constructed. The model can be interrupted if desired by the user. It is deterministic with a dynamic architecture that is event driven.

LIMITATIONS: TBD

INPUT:
- Forces and supply inventories
- Basic weapons performance data
- Other system performance data
- Geographic and terrain data
- Tactical decision tables

OUTPUT:
- Casualties and system losses (killer/victim scoreboards, etc)
- Flot traces and force positions overtime
- Target acquisition and intelligence summaries
- Availability and condition of forces and supplies
- Air battle and air defense results

HARDWARE AND SOFTWARE:

COMPUTER (OS): VMS

STORAGE: 800,000 Blocks

PERIPHERALS: None

PROGRAMMING LANGUAGE: SIMSCRIPT & FORTRAN

DOCUMENTATION: VIC Data Input & Methodology Manual
VIC Executive Summary
VIC Postprocessor User Guide

SECURITY CLASSIFICATION: UNCLASSIFIED

GENERAL DATA AND TIME REQUIREMENTS:

DATABASE: 2 Weeks

CPU TIME PER CYCLE: 4 Hour CPU/4 Hours battle time

FREQUENCY OF USE: Weekly at TRAC

USERS: TRAC, AMSAA, CAA, RAND

COMMENTS: Government agencies can obtain VIC with a signed memorandum of agreement. Government Contractors with a valid contract requiring the use of VIC can also obtain the model with the approval of the TRAC Commanding General. Inquiries for obtaining the model and supporting data bases should be addressed to TRAC-TOD, Ft. Leavenworth, KS 66027-5200 or call AV 552-5511 or commercial 913-684-5511.

TITLE: Vehicle Gap Crossing Under Fire Simulation - VGCUFS

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity.

POINT OF CONTACT: Director, USAMSAA, ATTN: AMXSY-CM (L. Martin) Aberdeen Proving Ground, MD 21005-5071, AV 298-6437/(301)278-6437

PURPOSE: A research and evaluation tool used at the item level. VGCUFS offers a means of assessing the effect a vehicle's automotive performance, or changes in vehicle parameters such as engine performance or weight, have on its survivability on the battlefield. The effect of specific terrain on the target vehicle-weapon encounter can also be examined.

DESCRIPTION:

Domain: Land.

Span: Individual.

Environment: Terrain mobility characteristics.

Force Composition: Individual element.

Scope of Conflict: Conventional.

Mission Area: Survivability to direct fire.

Level of Detail of Processes and Entities:

Entity: Individual vehicle.

Processes: Mobility, survivability.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time step.

Treatment of Randomness: Stochastic, direct computation for decision on existence of line-of-sight; remainder deterministic.

Sidedness: One-sided.

LIMITATIONS: One weapon firing at one target. The target does not return fire.

PLANNED IMPROVEMENTS/MODIFICATIONS: Analytical determination of the existence of line-of-sight using terrain elevation data will replace the statistical method currently in use. Vehicle performance along its path of travel will be simulated using the Army Mobility Model, replacing the current acceleration method.

INPUT: Target vehicle data required are weight, power train and traction characteristics. Terrain data required include surface slope, mean 'in view' segment length, mean 'out of view' segment length, and mean first opening range. Opposing weapon data required are horizontal and vertical bias and dispersion as a function of range and target speed, time to first shot, and time to subsequent shots. The target is described by a two rectangle fit of the target at the angle of attack being simulated, and range to target at start time.

OUTPUT: Graphs and tables give probability of each shot hitting the vehicle and elapsed time, distance traveled, range, and vehicle speed at shot time. Probability that the vehicle can cross the 'in view' segments and not be hit is also tabulated and plotted.

HARDWARE AND SOFTWARE:
Computer (OS): Cray-XMP (UNIX).
Storage required: Main program - 91594 bytes; Pre/post processors - 26300 bytes.
Peripherals: 1 printer, 1 color graphics copier.
Programming Language: FORTRAN.
Documentation: AMSAA CSD Interim Note No. C-151.

SECURITY CLASSIFICATION: (Model without data) UNCLASSIFIED.

GENERAL DATA:
Database: (time required to prepare) Many weapons and vehicles now reside in the data base. Additional weapons and/or vehicles can be added in a few hours if performance data are available.

CPU Time per Cycle: 1.94 seconds for one replication of the model running one vehicle/weapon combination.

Data Output Analysis: (time required) Analysis of graphical and tabular output required minimal effort. For a typical run of two weapons against three vehicles a maximum of 10 minutes is required.

TITLE: War Reserves for Combat Damage

DATE IMPLEMENTED: 1988.

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity.

POINT OF CONTACT: Stan Butler, DSN 298-4932, and Elaine Sadofsky, DSN 298-4980.

PURPOSE: The War Reserves for Combat Damage Model is used to predict Class IX replacement parts requirements rates for combat damaged fighting systems. The replacement rates are obtained by applying shotline damage probabilities to end item expected combat damage incidents categorized by threat weapon, range, and exposure condition. The model serves as a link between the U.S. Army Concepts Analysis Agency's Concepts Evaluation Model and Sustainability Predictions for Army Spare Component Requirements for Combat (SPARC) databases. The resulting predicted requirements rates are used in the yearly Class IX war reserves calculations by the Major Subordinate Commands.

DESCRIPTION:

Domain: Land and air.

Span: Theater-level requirements.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: Conventional.

Mission Area: Direct and indirect fire threat weapons damage.

Level of Detail of Processes and Entities:

Entities: modelled down to the Line Replaceable Unit (LRU).

CONSTRUCTION:

Human Participation: Required for decisions.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Considers only primary damage mechanisms such as high-explosive fragmentation, main penetrator, and spall damage.

Does not consider secondary damage mechanisms such as mechanical shock due to non-penetrating hits and fire propagation due to electrical shorts.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Vertical shotlines for top attack type threats are being developed for selected high-value fighting systems.

INPUT: Processed scenario information along with the SPARC database for a fighting system of interest.

OUTPUT: Output produced for a fighting system consists of combat damage factors for each component. The combat damage factors consist of Failure Factor Four (FFIV) and two combat intensity scaling factors tailored for the MSC's War Reserves Automated Process (WRAP).

HARDWARE AND SOFTWARE:
Computer: Recently transferred to a SING computer with a UNIX operating system.
Storage: 290Mb required for storage of current databases.
Peripherals: Requires secure and/or encrypted computing environment (see "SECURITY CLASSIFICATION" below).
Programming Language: FORTRAN, INGRES.
Documentation: Not extensively documented.

SECURITY CLASSIFICATION: Programs UNCLASSIFIED, but databases are classified up to the SECRET level.

GENERAL DATA:
Data Base: Development of a SPARC database for a fighting system can take 2-4 man-years, depending upon the complexity of the system and its vulnerability target description. The data and programs are considered to be not portable.

CPU Time per Cycle: N/A.

Data Output Analysis: Postprocessors aide in the task of converting the outputs to formats required for various applications.

Frequency of Use: Several times per year in support of processes such as Class IX War Reserves, Standardized Combat Authorized Stockage List/Prescribed Load List, etc.

Users: Due to portability considerations, AMSAA is the only hands-on user of the SPARC databases and programs.

Releasability: N/A.

TITLE: Weapon Effectiveness Battle Simulation - WEBS

DATE IMPLEMENTED: 1981.

MODEL TYPE: Analysis.

PROPONENT: CA4 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England.

POINT OF CONTACT: P. R. Syms, RARDE, ext 2452.

PURPOSE: Evaluation of Direct Fire land systems at the battlegroup (battalion) level.

DESCRIPTION:
Domain: Land.

Span: Local, tactical.

Environment: Stochastic terrain, using statistics gathered from runs of BGWG (q.v.) and (in near future) JANUS/BGWG (q.v.).

Composition Scope: Heterogeneous mechanized forces.

Mission Area: Direct fire battle. Typically, a 10km front.

Level of Detail: Individual vehicles and GW teams represented.

CONSTRUCTION:
Human Participation: None.

Time Processing: Event sequenced.

Treatment of Randomness: Stochastic.

Sidedness: Two-sided, fully symmetric.

LIMITATIONS: Limited ability to update tactics during a run. No ability to represent infantry, barriers or fixed wing aircraft. Terrain and routes are represented in a abstract manner, such that movement routes are constrained to East-West and North-South. No theoretical limit on unit numbers, but practically 120 Blue/300 Red.

PLANNED IMPROVEMENTS: Ability to transfer scenarios from JANUS/BGWG. Also minor model changes planned to some areas including target selection.

INPUT: Vehicles and weapon characteristics; Minefields and artillery mission data; Orbat, deployment, orders and tactics; Probability data.

OUTPUT: Killer/Victim tables, by replication and averaged; Firer/Target tables, by replication and averaged; Individual events on request.

HARDWARE AND SOFTWARE:
Computer/OS: DEC 11/750 and 6000 series computers; VAX/VMS.
Storage: Typically 200 blocks input data for a battlegroup scenario, 6000 blocks executable code. Output files anywhere from a few blocks to 20000 blocks, depending on amount of information requested.
Peripherals: Disc storage, line printer etc.
Language: FORTRAN 77. Some utilities written in Pascal.
Documentation: 4 volumes (user & programmers' guides, model definitions and executive summary. Updated with model).

CLASSIFICATION: Software is UNCLASSIFIED.

GENERAL DATA:
Time Required:
Data Preparation: A few hours to several weeks.

Preprocessor: None.

Simulation: ≈real time; highly dependent on machine and battle size.

Analysis Package: Yes.

Frequency of Use: In constant use. (Has experienced a renaissance sine simulation data last collect.)

Users: CA4 RARDE. TRAC-WSMR and AMSAA (APG) have older versions; it is unknown what use they make of them. DSc(L) MOD will possibly be using WEBS in the near future in place of SLEW (q.v.).